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ABSTRACT

A study identified four principles, based on transfer of learning research and cognitive theory, for guiding curricular decisions, instructional development, and teaching practices in ways that support transferable learning. The principles were as follows: (1) emphasize intermediate-level knowledge in curricular decisions; (2) create in the learning situation fidelity to transfer situations; (3) reflect the complexities of knowledge and its application in diverse, multidimensional contexts, problems, and situations; and (4) stimulate and challenge students to transfer their knowledge during learning and support their efforts to do so on their own. The basis for each principle and ways of incorporating it in educational practice were identified. The research tested the applicability of the principles by using them to create a parent education learning environment. A case analysis approach to instruction was formulated to help parents develop flexible knowledge and appropriately complex understanding. Strategies used to stimulate learner-directed knowledge transfer during learning included a scaffolding approach to teaching and reflective dialog among parents. The learning environment was field tested in 5 sites with 31 parents. Not only did parents' learning reflect characteristics identified as enhancing "high road" transfer but parents engaged in high road learning transfer as well. (Contains 87 references.) (YLB)

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TEACHING FOR TRANSFER OF LEARNING

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PREFACE

This document is part of the National Center for Research in Vocational Education's (NCRVE) continuing effort to understand and improve vocational curriculum and instruction. It is one in a series of documents concerning teaching and learning. This document outlines four principles for guiding curricular decisions, instructional development, and teaching practices to enhance transfer of learning. The principles are based on cognitive theory and on research on transfer of learning. Application of the principles to instruction within a specific vocational education program area is reported. A field study designed to test the impact of the instruction on transferable learning by students is also reported. Based on the findings, conclusions, implications for vocational education, and recommendations are outlined. The document should be of special interest to researchers, practitioners, teacher educators, and policymakers concerned with integration of vocational and academic education and with renewal and revitalization of American education in general.

EXECUTIVE SUMMARY

Problem and Purpose

This research focused on applying cognitive theory to curricular decisions, instructional development, and teaching practices. A rapidly changing societal context is a major force underlying interest in applying cognitive theory in education. Rapid societal change and growing complexity of life and work are making predictions about the future more difficult. Because it is becoming increasingly difficult to predict specifically what people will need to know and be able to do in the future, their capacities to transfer what they know to previously unencountered problems and to learn on their own are becoming increasingly important.

Transfer has been defined as the capacity to (1) see as relevant in a new context something that was learned in a different context, (2) apply what has been learned in another context to a new context, and (3) apply old knowledge in a new context that is sufficiently novel to require learning of new knowledge. Although all transfer necessarily involves both prior learning and new learning, different types of transfer involve different kinds of learning.

When a new situation is readily perceived as similar to a familiar one, and when well-practiced habits in responding to the familiar situation have been developed, transfer can be almost automatic. This kind of transfer is referred to as low road transfer. In contrast, when few or no similarities between prior learning and a new problem or situation are readily perceived, deliberate, mindful abstraction of skill or knowledge is required in order to see or create the similarities needed for transfer to occur. This kind of transfer is referred to as high road transfer.

While both kinds of transfer are needed and help people use their knowledge, high road transfer is especially critical in a rapidly changing societal context which confronts people with new challenges and unfamiliar problems in every aspect of their life. Unfortunately, however, many of the failures to demonstrate transfer of learning from instruction have involved high road transfer. More recently, developments in cognitive theory and research on transfer have contributed to a fuller understanding of conditions that promote and impede transfer and of the nature of complex thought processes involved in high road transfer.

The purposes of the research reported here were to (1) identify principles, based on transfer of learning research and cognitive theory, for guiding curricular decisions, instructional development, and teaching practices in ways that support transferable learning; (2) test the applicability of the principles by using them to guide curricular decisions, instructional development, and teaching practices within a specific vocational education program area; and (3) test the impact of instruction, based on the principles, on transferable learning by students.

Teaching for Transfer: Guiding Principles

Four principles for guiding curricular decisions, instructional development, and teaching practices to enhance transfer of learning were identified. The principles address both low road and high road transfer, although most of them focus on enhancing high road transfer. The basis for each principle is outlined and ways of incorporating it in educational practice are discussed in the report. A brief summary of each principle is provided here.

Principle I: Emphasize Intermediate-Level Knowledge in Curricular Decisions

Cognitive theorists have recommended that curriculum should emphasize knowledge and skills of intermediate generality, taught within contexts and problems that are meaningful to students and within the world outside of school, and taught in such a way that abstracting them from the specifics within which they were learned is made easier. Intermediate-level knowledge is domain-related (but not tied to only one domain) and relevant to numerous situations and problems. Intermediate-level knowledge is critical to high road transfer because, if it can be abstracted and connected to new problems as they arrive, it allows the problems to be understood and reformulated in terms of concepts and strategies that can lead to solutions.

Principle II: Create in the Learning Situation Fidelity to Transfer Situations

Fidelity reflects the authenticity of the learning situation with respect to potential transfer situations. It is the faithfulness of the learning situation to the realities transfer situations present. Fidelity can be established along a number of dimensions which include surface features, context, deep features, and kinds of mental processing. *Surface features* are those which relate to outward appearance. They are descriptive attributes and details that are perceptible through direct sensory detection without extensive interpretation. Surface feature fidelity aids low road transfer. It is reflected when learners experience activities, materials, tools and equipment, examples, problems, cases, and situations that are typical in transfer situations.

Context has to do with events or conditions that surround initial learning and that trigger memories of that learning if encountered in transfer situations. Such surrounding conditions may include a general atmosphere, a physical setting, or things that are going on at the same time in the background. *Deep feature* fidelity reflects commonality between the learning situation and the transfer situation in deep, structural, causal features. Principles and general concepts in a domain of knowledge reflect deep features. They are a central route along which high road transfer occurs. Fidelity of the learning situation in *kinds of mental processing* is reflected when students are engaged during learning in the kinds of mental processing transfer situations require. Paying attention to all four types of fidelity in developing instruction helps learners to connect specific details reflected in real and meaningful problems with general, abstract knowledge.

Principle III: Reflect the Complexities of Knowledge and its Application in Diverse, Multidimensional Contexts, Problems, and Situations

Knowledge transfer is often not straightforward. Reformulation and restructuring of prior knowledge is often necessary in order for transfer to occur. This requires that knowledge be flexible and that understanding of it be sufficiently complex to avoid misconceptions and inappropriate transfer. *Flexible knowledge* is connected to many different circumstances, problems, and situations. Its multiple, varied connections set the stage for further connection-making and for its being restructured in many different ways. *Appropriately complex understanding* avoids oversimplification. It results from instruction that avoids making knowledge and its application neater and more regular than they are. The flexibility of knowledge and understanding of its complexities are believed to be enhanced when the learning situation emphasizes multiple contexts, problems, and situations.

Principle IV: Stimulate and Challenge Students to Transfer Knowledge During Learning, and Support Their Efforts to Do So on Their Own

Because high road transfer is intentional learning transfer, it depends on a *stance of self-directedness*. Self-directedness has to do with learners monitoring themselves and viewing themselves as being in charge of their learning rather than expecting others, such as the teacher, to direct them. The roles in which instruction casts students affects their self-directedness. Roles in instruction that confront students with the need to use knowledge, to reason with it, and transfer what they learn help them develop a stance of self-directedness. Direct teaching of thought processes and dispositions relevant to knowledge transfer, and of approaches for transferring learning that students can use on their own, also supports self-directedness.

Application of Guiding Principles

To address the second purpose of the research, the principles were applied to the development of a learning environment for parent education. High road transfer was of central interest in development of the learning environment. The learning environment was developed to support high road transfer by focusing on parental perspectives as intermediate-level knowledge and interpersonal interaction themes as deep features of parent-child interaction. A case analysis approach to instruction was formulated to help parents develop flexible knowledge and appropriately complex understanding. Several strategies were used to stimulate learner-directed knowledge transfer during learning, including a scaffolding approach to teaching and reflective dialogue among the parents.

Impact on Learning of Instruction Guided by the Principles

To address the third purpose of the research, a field test of the learning environment was designed to provide evidence regarding the learning of parents who experienced it as a way of exploring the strength of the guiding principles that influenced its development. The learning environment was field tested in five sites representing various educational

settings and involving thirty-one parents of varying ages, educational backgrounds, and socioeconomic situations. Two kinds of data were sought as evidence of transferable learning: (1) the presence of characteristics of transferable learning, and (2) learning transfer by parents. Characteristics of learning that is transferable in the high road sense reflects intermediate-level knowledge, deep features, flexibility and appropriately complex understanding, and a stance of self-directedness on the part of the learner toward it. Data regarding transfer-related characteristics of parents' learning and their learning transfer were collected before, during, and after their participation in the learning environment. Findings revealed that parents' learning reflected characteristics identified as enhancing high road transfer, and that parents engaged in high road learning transfer.

Conclusions

Conclusions are outlined below in relation to the three purposes of the research.

Regarding the first purpose, four principles for guiding curricular decisions, instructional development, and teaching practices to support transferable learning were identified. The basis for each principle was discussed, and instructional design and teaching approaches relevant to it were identified. Regarding the second purpose, the principles were used in creating a parent education learning environment. The following conclusions are based on this experience in applying the guiding principles:

- *Because they represent broad areas of consideration, the guiding principles are flexible and anticipated to be applicable to curricular decisions, instructional development, and formulation of teaching practices in many different subject areas.* Because the principles are broad, there are many different ways to apply them. Rather than highly specific prescriptions, the guiding principles provide a way of organizing thinking about curricular decisions, instructional development, and teaching practices.

- *Instruction guided by the principles is adaptable to different settings, audiences, and time frames.* Application of the guidelines resulted in a highly flexible design for instruction that was adaptable to educational programs in different contexts and with differing time frames, and which served different audiences.

- *Application of the principles revealed the importance of a deep understanding of the knowledge domain and of research in making that understanding possible.* Understanding of the knowledge domain was possible because research related to it was available. Without this understanding, the principles could not have been applied.

Regarding the third purpose of the research, the following conclusion is based on field test findings:

- *Learning by students who experienced instruction guided by the principles reflected transferability characteristics relevant to high road transfer and was transferred by the students to multiple contexts, problems, and situations.* Transferable learning, in the high road sense, is intermediate in level, reflects deep features of problems and situations, is flexible and reflects appropriately complex understanding, and is seen by learners as responsive to their own direction and intent. Evidence obtained from the field test of the learning environment suggested that the learning by parents which occurred during the field test had these characteristics. Furthermore, learning of this depth and complexity occurred over a relatively brief time. In addition, students transferred their knowledge in many different ways during learning, and transfer of learning was evident after parents' experience with the learning environment had ended.

Implications for Vocational Education

The nature of the guiding principles and their consequences for instruction and learning have implications for vocational education research, educational practices, and curricular priorities. These implications include the following:

- *Focusing instruction on intermediate-level knowledge, deep features, and mental processes requires a different kind of research than that which underlies much instructional development in vocational education.* Much vocational education research intended to support curriculum and instructional development has emphasized behavioral task analysis. Behavioral task analysis does not provide the kind of information needed to support instructional development that enhances high road transfer. Rather, it leads to instruction which emphasizes low road transfer.

This is because its focus on observable, behavioral dimensions of transfer situations emphasizes surface features and developing well-practiced habits for specific tasks and settings. Because it does not emphasize breadth of application or the deeper concepts and principles and mental processes on which high road transfer depends, it is not well-suited to developing instruction that fosters high road transfer. Examples of the kind of research that is needed are cited.

- *Application of the guiding principles requires understandings and teaching practices that may differ from those teachers have been taught.* Applying the guiding principles requires an understanding of intermediate-level knowledge, deep features, and mental processes relevant to transfer situations and knowledge domains, and of how to teach for transfer, especially high road transfer. Teachers need opportunities to gain such understanding.

- *High road transfer is a relevant priority for vocational education.* To a large extent, vocational education priorities have focused on low road transfer. As the forces of rapid change and increasing complexity exert their influence on the workplace and other areas of life, high road transfer is becoming increasingly important. Trends in vocational education that reflect concerns related to high road transfer include the view that training should have relevance to industry-wide employment, and the interest in integrating vocational and academic education.

- *Ways to assess transferable learning are needed.* The kind of learning that leads to high road transfer is not assessed by tests of knowledge recognition, recall, and performance in a narrowly defined arena. Assessments that can detect complex and deep understanding, integration, flexibility, and reconstruction of knowledge are needed.

Recommendations

The following recommendations for teachers, researchers, teacher educators, and policymakers are based on the conclusions and implications outlined in the preceding sections:

- In light of increasing needs for high road transfer in a societal context of rapid change and growing complexity, give more emphasis to high road transfer in vocational education and to approaches to curriculum and instructional development that support it.

- Further test the guiding principles, their consequences for instruction and learning, and their usefulness by applying them to instruction in various educational areas at all levels, involving a variety of audiences, and by using them to support efforts aimed at integrating vocational and academic education.

- Conduct research to determine the extent to which the guiding principles are already expressed in vocational programs.

- Focus research efforts on understanding intermediate-level knowledge, deep features, and mental processes relevant to transfer situations and knowledge domains of interest in vocational education. Involve teachers in these research efforts.

- Expose teachers through preservice and inservice teacher education to concepts and issues related to high road transfer of learning and to approaches for developing instruction and teaching that address such transfer.

- Identify ways of assessing transferable learning that already exist and develop new approaches for assessing such learning. Look for evidence that students are transferring learning both during and following instruction. Determine persistence and breadth of transfer over time.

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PROBLEM AND PURPOSE

This research focused on applying cognitive theory to curricular decisions, instructional development, and teaching practices. A rapidly changing societal context is a major force underlying interest in applying cognitive theory in education. Rapid societal change and growing complexity of life and work are making predictions about the future more difficult. Because it is becoming increasingly difficult to predict specifically what people will need to know and be able to do in the future, their capacities to transfer what they know to previously unencountered problems and to learn on their own are becoming more important.

Transfer has been defined as the capacity to see as relevant in a new context something that was learned in a different context, apply what has been learned in another context to a new context, and apply old knowledge in a new context that is sufficiently novel to require learning of new knowledge (Feltovich, Coulson, Spiro, & Dawson-Saunders, in press; Larkin, 1989; Perkins & Salomon, 1988). Transfer involves using knowledge in many different ways. Although all transfer necessarily involves both prior learning and new learning, different types of transfer involve different kinds of learning as discussed below.

While the transfer of learning has historically been valued as a goal of education, the means for accomplishing it have been elusive. Failure to transfer learning is well-documented in the literature (Detterman, in press; Hudgins, 1977; Larkin, 1989). Some theorists have attributed the difficulties in achieving transfer to a failure to sense critical differences in types of transfer (Perkins & Salomon, 1988). For example, transfer has often been assumed to be a natural by-product of learning. If learning occurs, transfer will take care of itself. For some types of transfer, this seems to be the case. Transfer can be almost automatic when features of a new situation are readily perceived as similar to those that characterize a familiar situation, and when well-practiced habits in responding to the features have been developed. For example, a student who has developed habits of studying that have produced high scores on tests in high school may readily transfer those patterns of study to preparing for similar tests encountered in further education. An office worker who has learned to work with a particular database in one office setting may find a new database in a different office easy to learn if many aspects of it are similar to the already familiar database program. This kind of transfer depends on learning as acquisition of knowledge or skill, and is referred to as low road transfer (Perkins & Salomon, 1987, 1988).

Transfer contexts that are more remote from the learning context, however, involve a different kind of transfer that is more challenging. When few or no similarities between prior learning and a new problem or situation are readily perceived, deliberate, mindful abstraction of skill or knowledge is required in order to see or create the similarities needed for transfer to occur. This kind of transfer depends on learning as conceptual change—as seeing the familiar in new ways—and has been referred to as high road transfer (Perkins & Salomon, 1987, 1988). In contrast to low road transfer, which is driven by environmental features, high road transfer is driven by personal intent. High road transfer involves intentionally focusing reflective thought on abstracting general skill or knowledge from one context for application in another. In this process, general aspects of prior learning are broken free of their accidental associations with superficial features of the context in which they were learned (Perkins & Salomon, 1988).

Not surprisingly, many of the failures to demonstrate transfer of learning have involved high road transfer (Perkins & Salomon, 1988). The difficulty of demonstrating high road transfer, and the extent to which it seems to depend on learning as creative insight, have led some scholars to question whether it is a realistic goal for education to seek (Brooks & Dansereau, 1987; Detterman, in press; Hudgins, 1977; Perkins & Salomon, 1988). Other scholars suggest that we have been too unrefined in our search for transfer, and that we have not yet learned the extent to which education can support transfer of learning. These scholars believe that the growing availability of more refined understandings of what makes learning transferable, the kinds of thinking and learning involved in high road transfer, and how to teach for transfer, can make systematic efforts to improve the transferability of learning worth pursuing (Feltovich, Spiro, & Coulson, 1989; Perkins & Salomon, 1988; Spiro, Coulson, Feltovich, & Anderson, 1988; Spiro, Vispoel, Schmitz, Samarapungavan, & Boerger, 1987).

Some theorists contend that faulty assumptions about the nature of knowledge and how it is acquired are at the root of problems in achieving transfer of learning (Paul, 1987; Spiro et al., 1987). They contend that a view of knowledge as a prepackaged, finite commodity which can be moved intact from one problem to another has pervaded education and has led to a view of transfer as a process of activating knowledge that is stored in memory and selecting that which is relevant for application to a new task, situation, or problem. This view of transfer does not reflect the "constructed to fit the situation" view of knowledge implied in high road transfer and in studies of transfer of learning in everyday life. For example, research has revealed that people may adjust either the new or already familiar situations or both to achieve a better fit between the familiar and the new (Feltovich et al., in press; Lave, Murtaugh, & de la Rocha, 1984; Scribner, 1984, 1986). Instead of a linear process of activating, selecting, and applying knowledge, high road transfer entails a dialectic process of going back and forth between perceived dimensions of a new problem and fragments held in memory of interpretations of prior experiences. Through this back and forth, reflective process, knowledge is constructed or assembled to fit the problem.

The nature of high road transfer as personal intent-driven reflection, abstraction, and reconstruction of knowledge, makes it valuable in a rapidly changing societal context which confronts people with new challenges and unfamiliar problems in every aspect of their lives. Yet, the nature of high road transfer as personal intent-driven raises the question of what kind of teaching and learning will help learners develop their desire and capacities to initiate and engage in these processes on their own. At its core, high road transfer entails the assumption of responsibility for self-initiated generation of new meanings and connections. A critical thing that must happen in teaching and learning for high road transfer is that this responsibility must be passed from the teacher to the learner.

Cognitive theory, along with research on transfer, have contributed to understanding conditions that promote and impede transfer. Because high road transfer involves complex thought processes, cognitive theory offers particular potential for contributing to understanding of high road transfer and to developing ways of teaching that support it. The purposes of the research reported here were to (1) identify principles, based on transfer of learning research and cognitive theory, for guiding curricular decisions, instructional development, and teaching practices in ways that support transferable learning; (2) test the applicability of the principles by using them to guide curricular decisions, instructional development, and teaching practices within a specific vocational education program area; and (3) test the impact of instruction, based on the principles, on transferable learning by students. Curricular decisions are judgments concerning which educational priorities, aims, and goals are of value and what kinds of learning are relevant to them. Instructional development refers to the identification, creation, and organization of environments, activities, processes, and materials intended to support learning. Teaching practices are the enactment of teaching, the moves and actions of teachers that are intended to support learning. The meaning of transferable learning is developed throughout the following sections.

TEACHING FOR TRANSFER: GUIDING PRINCIPLES

This section addresses the first two purposes outlined above. Four principles for guiding curricular decisions, instructional development, and teaching practices to enhance transfer of learning are outlined, and their application in the development of a vocational education learning environment is described. The four principles incorporate cognitive theory and are based on research on transfer of learning which points to conditions necessary for transfer to occur, and that facilitate and impede transfer. The four guiding principles are

1. Emphasize intermediate-level knowledge in curricular decisions;
2. Create in the learning situation fidelity to transfer situations;
3. Reflect the complexities of knowledge and its application in diverse, multidimensional contexts, problems, and situations; and
4. Stimulate and challenge students to transfer their knowledge during learning, and support their efforts to do so on their own.

Each principle is discussed in this section in terms of its basis and ways of incorporating it in curriculum and instruction. Application of each principle in designing a particular learning environment within vocational education is also reported. The principles encompass both low road and high road transfer, although most of them focus on enhancing high road transfer. High road transfer was of central interest in the learning environment to which the principles were applied.

Principle I: Emphasize Intermediate-Level Knowledge in Curricular Decisions

Most of the time, teachers do not expect to teach students all they need to know. Most subjects taught in formal education at all levels represent large complexes of knowledge that cannot be comprehensively taught at a highly detailed level. This situation makes it necessary to focus teaching on only some of what could possibly be taught. Earlier in the history of formal education, educators solved the problem of what to teach by selecting subjects believed to develop highly general, widely transferable knowledge, skills, and capacities (Hudgins, 1977; Larkin, 1989). This strategy, which stemmed from faculty psychology (a view that learning certain subjects would develop mental faculties), was reflected in the widespread formal schooling practice of teaching Latin, for example, for its perceived value in developing general mental capacities.

Faculty psychology, and the beliefs about educating that it generated, were refuted by Thorndike's evidence that such highly general transfer did not occur. Thorndike proposed instead that transfer was specific rather than general, and occurred when a new problem or situation reflected a sufficient number of specific elements similar to those contained in already familiar problems and situations (Thorndike & Woodworth, 1901). Thorndike's common elements theory of transfer led to curriculum focused more directly on specific things people needed to know in their work and personal life, and as a citizen. As these areas of life have become more subject to rapid change and have become more unpredictable as a result, this highly specific approach to curriculum is becoming less useful. As a result, renewed interest in teaching general knowledge and skills has led to teaching highly general skills perceived as having wide applicability (such as problem solving), and doing so outside the context of any particular domain. These attempts have been largely unsuccessful (Larkin, 1989).

Cognitive theory and research have suggested that transfer is more specific than acknowledged by the faculty psychology view and the practice of teaching highly general skills by themselves (Larkin, 1989; Resnick, 1987). On the other hand, cognitive theorists have also suggested that general concepts and principles that are too rigidly tied to particulars are not transferable either (Larkin, 1989; Spiro et al., 1987, 1988). Studies that have compared experts and novices in a wide range of domains suggest that experts understand highly general, but domain-related, concepts and principles that can be abstracted to serve as the routes of traversal across many different problems and situations (Ericsson & Polson, 1988; Lawrence, 1988; Lesgold et al., 1988). These concepts and principles are linked to a multiplicity of specifics that reflect the different ways problems present themselves in the world. The connections to many different specifics is what keeps the general knowledge flexible, open to further connections.

Based on these understandings, cognitive theorists have recommended that curriculum should emphasize knowledge and skills of intermediate generality, taught within contexts and problems that are meaningful to students and within the world outside of school, and taught in such a way that abstracting them from the specifics within which they were learned is made easier. This intermediate-level knowledge is domain-related, but is not tied to only one domain. It includes broad concepts, principles, perspectives, and forms of mental processing that are reflected in many aspects of a domain and that are relevant to several domains (Larkin, 1989; Perkins & Salomon, 1988). Intermediate knowledge is widely, but not universally, relevant knowledge that can be called upon in relation to numerous situations and problems. For example, the concept of motivation is central in and, cuts across, such domains as sales and marketing, consumer economics, interpersonal relationships, psychology, and education. Likewise, the concept of control is central in and, cuts across, such domains as manufacturing, cost accounting, livestock and crop production, and scientific method.

Intermediate-level knowledge reflects general perspectives and principles that are embedded in domain-related problems, tasks, and situations. Intermediate-level knowledge and skill is critical to high road transfer because, if it can be abstracted and connected to new problems as they arrive, it allows the problems to be understood and reformulated in terms of concepts and strategies that can lead to solutions (Gray & Orasanu, 1987; Larkin, 1989). For example, reformulating a student's apparent lack of interest in learning as a possible motivation problem suggests avenues of inquiry a teacher might pursue with the student, as well as possible strategies for dealing with the problem.

Because intermediate-level knowledge takes time and sufficient breadth and depth of experience to understand well, and because instructional time and resources are almost always limited, it is usually possible to emphasize only a part of all that might be relevant to any given educational goal. Feltovich et al. (1989) have suggested the following three criteria for guiding curricular decisions about what intermediate-level knowledge to emphasize: (1) centrality within the domain (a concept that is central is related to many different aspects of the domain); (2) importance to the learning goals; and (3) difficulty for students to learn, understand, and apply. Which concepts, principles, and processes in a domain meet such criteria may not be immediately apparent. Procedures for identifying them which involve practitioners in areas relevant to the domain of interest have been developed.

Application of Principle I: Identifying Intermediate Knowledge

Much of the research on transfer on which the four guiding principles are based has been done in the physical and biological sciences, in technical domains of knowledge, and in laboratory studies involving highly restricted tasks. There is far less transfer research in areas focused on the social sciences and conducted in the naturalistic contexts of real educational programs. Because of the dearth of transfer research involving social science areas and naturalistic teaching contexts, focusing on these in testing the guiding principles was viewed as providing a more stringent test of their applicability to a wide range of instructional areas. The social sciences are emphasized in several vocational education program areas such as home economics, parent education, child care and development, and business and marketing. Parent education was chosen as the program area for testing the principles.

The central aim and interest underlying the learning environment that was developed was helping parents develop their capacities to support the development of their children. The knowledge domain selected for testing the applicability and impact of the guiding principles was parent-child interaction. Research over the past twenty years on children's development in relation to environmental factors has revealed that the qualities and patterns of parent-child interaction have long-term as well as short-term impact on children's development. For example, research on children's early environments has indicated that certain patterns of parent-child interaction during infancy and early childhood are particularly cogent in promoting children's immediate and later cognitive and social development (Ainsworth & Bell, 1974; Ainsworth, Blehar, Waters, & Wall, 1978; Baumrind, 1975; Beckwith, 1976; Beckwith, Cohen, Kopp, Parmelee, & Marcy, 1976; Bromwich, 1981; Bronfenbrenner, 1991; Epstein & Evans, 1979; Gulley, 1982; Matas, Arend, & Sroufe, 1978; McGovern, 1990; Rubinstein, 1967; Sameroff, 1986; Sameroff, 1975; Stevenson & Lamb, 1979). Patterns and qualities of parent-child interaction have been related to language development and to children's later academic achievement, and have been found to be a powerful predictor of children's development across social classes (Bromwich, 1981; Epstein & Evans, 1979).

The qualities of parent-child interaction have also been related to social development and to the qualities of the parent-child relationship and those of relationships children establish with others throughout their lives (Bretherton & Waters, 1985; McGovern, 1990). Research on parent-child interaction suggests that children who experience warm, nurturing interactions and relationships are less likely to turn to drug abuse and adolescent sex to try to fulfill dependency needs unfulfilled earlier in life. Such children are also more able to establish satisfying relationships with others throughout life, including with their own children. Conversely, children who do not experience such interactions and relationships during their formative years are more likely to have a troubled adolescence and, when they become parents, to perpetuate a cycle of unmet needs and troubled children from one generation to another.

Researchers and clinicians have suggested that the experience of parenting provides opportunities for parents as well as children to develop cognitively and socially. Developmental patterns have been identified in both parental cognition and behavior (Bromwich, 1981; Newberger, 1980a; Newberger & Cook, 1983). Newberger has identified four levels of parental awareness which reflect a progression in depth and complexity of parents' perspectives and thinking. A perspective is how something is viewed and interpreted. The four levels include egoistic, conventional, individualistic, and analytic. Parents at the first, *egoistic*, level have a self orientation. They see their children and their parenting practices only in terms of their own interests and needs, and in terms of how they, themselves, are affected. Parents at the second, *conventional*, level have a norms orientation. They view their children and their parenting practices in terms of conventional norms, including age-related norms for children's development and societally prescribed norms for child-rearing. They see themselves and their children as members of a class or category having well-defined roles which they are responsible for fulfilling, and the parent-child relationship as mutual fulfillment of role obligations.

Parents at the third, *individualistic*, level have a child orientation. They view their children and themselves as unique individuals who also share some universal qualities with other people. The parent-child relationship is seen as an exchange of feelings and sharing of perspectives, rather than only as the fulfillment of role obligations. Parents at the fourth, *analytic*, level have a systems orientation. They view parenting, self, and child as embedded within interacting, mutually influential systems of relationships. They see their children as psychologically complex and view both children and parents as growing and maturing through the parent-child relationship and parenting process. Parenting practices are seen as having broad origins, meanings, and consequences that extend beyond the parent-child relationship.

Each higher level perspective embeds, rather than replaces, the ones below it. Consequently, parents at the higher levels have more perspectives available. The perspectives represent intermediate-level knowledge central to several parenting-related domains. For example, Newberger and Cook (1983) have provided evidence that the perspectives parents hold about themselves and the parental role, their children, and the nature and meaning of the parent-child relationship influence their interpretations of children's behavior, and the policies they use to guide their parental actions. Consequently, it would be expected that parent-child interaction, as an area of parental practice, would be affected by the perspectives. Evidence that this is the case is provided by Cohler, Weiss, and Grunebaum (1970), who report that parents experiencing problems in establishing the parent-child relationship have been found to view their infant as unable to communicate with them. Their interactions with their infant reflect lack of attention and response to the infant's cues and few attempts to engage the infant in reciprocal exchanges. A progression of perspectives similar to those identified by Newberger have been identified in groups other than parents (Hunt, 1971), suggesting that the perspectives may be broadly applicable and relevant to a variety of interpersonal relationships that involve a more mature person who is in a position of opportunity to support and foster development of a less mature person (such as teacher-student, trainer-trainee, mentor-mentee, and coach-learner).

Principle II: Create in the Learning Situation Fidelity to Transfer Situations

Transfer requires that commonality between prior learning and a transfer situation be detected or imposed so that the relevance of prior learning can be signaled. Transfer situations include the general parameters, the areas of prospective application, over which transfer is reasonable and desirable (Kennedy, Fisher, & Ennis, 1991; Larkin, 1989). Commonality between prior learning and transfer situations can be established along a number of dimensions which include surface features, context, deep features, and kinds of mental processing (Gick & Holyoak, 1987). Fidelity promotes the establishment of such commonalities by learners and thereby enhances transfer of learning. Fidelity is the faithfulness of the learning situation to the realities transfer situations present (Elstein, Shulman, & Sprafka, 1978). Fidelity reflects the authenticity of the learning situation with respect to transfer situations.

Surface features are those which relate to outward appearance (Gick & Holyoak, 1987; Perkins & Salomon, 1988). They are descriptive attributes and details that characterize objects, people, tasks, situations, conditions, problems, and events, and are perceptible through direct sensory detection without extensive interpretation. For example, most people can readily detect the smell of smoke. Fidelity of the learning situation to transfer situations in surface features is reflected by learners experiencing activities, materials, tools and equipment, examples, problems, cases, and situations that are similar to those contained in transfer situations. Because surface feature fidelity reflects the terms in which cases and problems present themselves in the real world, it aids learning of environmental cues and behavioral responses to them which drive low road transfer. Such fidelity helps learners readily perceive similarities between the learning situation and a transfer situation. Efforts in vocational education to expose learners to up-to-date equipment and procedures that reflect those used in work settings reflect efforts to incorporate surface feature fidelity.

Commonality between prior learning and a new experience can also be established in terms of *context* (Gick & Holyoak, 1987). Context has to do with events or conditions that surround learning and that trigger memories of that learning if they are encountered in transfer situations. Such surrounding conditions may include a general atmosphere, a physical setting, or things that are going on at the same time in the background. Context fidelity is reflected when the learning situation context is similar to that of transfer situations. Lack of context fidelity can be a barrier to transfer of learning. For example, it is one thing to learn to shoot baskets when one is by oneself and relaxed, and quite another to do so within a highly competitive game in which opponents are trying to capture the ball and block the shot. Likewise, learning trouble-shooting as though cost did not matter does not bear contextual similarity to most trouble-shooting situations in real-life. Preparing people as repair technicians by having them learn their work only under blazing lights and in a comfortable physical position does not reflect the dimly lighted, tight, and inconvenient spaces in which this kind of work is often done.

Context fidelity is often incorporated in education through field experiences, practica, and internships that take place in real-world settings. Supervised work experience and cooperative education have been additional avenues used in vocational education for achieving this kind of fidelity in the learning situation. Because these approaches expose learners to real-world tasks, problems, and situations, they also reflect surface feature fidelity. Context fidelity can also be enhanced in classroom learning by paying attention to contextual elements when projects, simulations and laboratory work are planned. Emphasizing real cases or examples as they occur in their natural contexts rather than artificial, stripped down textbook examples is also a way of enhancing both surface feature and context fidelity in classroom instruction (Spiro et al., 1987, 1988). Perkins and Salomon (1988) refer to this as *hugging*, the practice of introducing knowledge to be learned within a problem or case from a particular context. Like surface feature fidelity, context fidelity also aids learning of environmental features which drive low road transfer.

In contrast to descriptive-level, surface feature fidelity, *deep feature* fidelity reflects commonality between problems and cases experienced in the learning situation and those encountered in transfer situations in deep, structural, causal features. Deep features are general, abstract in nature. This is why they are a central route along which high road transfer occurs. Deep features can be abstracted from prior experience and used in understanding and dealing with a new problem or situation in high road transfer. Because high road transfer depends on an accurate, adequate understanding of these features, instruction which fails to support learning of them limits this kind of transfer (Gick & Holyoak, 1987; Resnick, 1987). Principles and general concepts in a domain of knowledge that are represented in a wide variety of problems, situations, and tasks reflect deep features. For example, the concepts of structure in relation to price variation represent deep features of markets. Goals embedded in situations, tasks, and problems have been identified as a deep feature that provides especially salient cues to past experience (Gick & Holyoak, 1987; Resnick, 1987). Themes have been identified as a type of deep feature that groups together many situations and problems which differ widely in appearance (in surface features), and that generate, organize, and give meaning to goals (Schank & Abelson, 1977; Spiro et al., 1987, 1988).

As they are defined here, deep features represent domain knowledge. Intermediate-level knowledge, on the other hand, transcends several knowledge domains. Because knowledge domains can be defined at different levels of generality, what is identified as deep features and as intermediate knowledge is not absolute, but, rather, needs to be considered in relation to the knowledge domain of interest. For example, some knowledge relevant to the domain of market economics would also be relevant to other domains of economic knowledge and could be considered intermediate-level knowledge when the domain of interest is market economics. The same knowledge that transcends domains of economic knowledge may not, however, be relevant to domains outside of economics. Consequently, when the domain of interest is economics, it may represent deep features. The field study reported later provided an opportunity to empirically explore the issue of relationship between intermediate-level knowledge and deep features.

Incorporating deep feature fidelity in the learning situation involves exposing learners to problems and cases that reflect deep features contained in transfer situations, and engaging learners in ferreting them out. Detecting deep features requires learners to see below surface appearances to causal elements and consequences, and to note cues to their presence that are often subtle and require special knowledge to notice and interpret.

A fourth dimension along which commonality between the learning situation and transfer situations can be established is in terms of the kinds of *mental processing* that is required (Gick & Holyoak, 1987; Perkins & Salomon, 1987). Fidelity of the learning situation to transfer situations along this dimension entails engaging students during learning in the kinds of mental processes that transfer situations require. Incorporating such fidelity requires an understanding of mental processes entailed in transfer situations. For example, mental processing in real-world problems entails going back and forth between what is already known and new information and mentally making adjustments in both to achieve a better fit. *Cognitive apprenticeship* and situated cognition are instructional approaches that incorporate mental processing fidelity and other kinds of fidelity in the learning situation (Brown, Collins, & Duguid, 1989; The Cognition and Technology Group At Vanderbilt, 1990; Collins, Brown, & Newman, 1989; Gott, 1988). These approaches, which have emerged from cognitive theory and research, emphasize the use of knowledge rather than the recall of knowledge, and they reflect the influence of context on how knowledge is used. They seek to make mysterious, invisible mental processes central to transfer situations visible so that students can observe, enact, and practice them with help from the teacher and from other students (Collins et al., 1989). Mental processes are made visible through dialogue, explanation, modeling, and encouragement. Because dialogue provides opportunities for students to express themselves, it is also an important source of information for the teacher regarding students' thinking processes and understanding of concepts. Cognitive apprenticeship and situated cognition represent teaching approaches that attempt to respond to the growing role that complex cognitive processes play in real-world problems (Raizen, 1989).

Incorporation of all four types of fidelity in developing instruction contributes to accurate, adequate learning by avoiding distortions in the learning situation. Paying attention to all four types of fidelity also helps learners connect learning of specific details reflected in real and meaningful problems with learning of general, abstract knowledge. In contrast, learning situations that focus only on deep features in the abstract, leave general knowledge unconnected to specific situations and problems that give it meaning. Likewise, learning situations that focus only on surface features and context fail to support high road transfer because they omit critical routes along which high road transfer can potentially occur. Decisions about the extent to which each kind of fidelity is warranted and can be incorporated need to be made. For example, in areas of instruction characterized by rapid change and unpredictability, and when a goal of education is improving the transfer situation rather than just maintaining it as it is, it may be impossible to sufficiently identify the surface features of the transfer situation to strongly support low road transfer. In such areas, high road transfer is critical, and emphasis is needed on the kinds of fidelity that support it. Hugging, simulations, use of real-world settings in learning as in apprenticeship, and cognitive apprenticeship are ways of simultaneously incorporating several dimensions of fidelity in the learning situation.

Application of Principle II: Defining Transfer Situations and Incorporating Fidelity

Transfer situations encompass the general parameters, the areas of prospective application, over which transfer might be reasonably expected and desirable. Parent-child interactions occur across children's developmental stages and within a great variety of activities, tasks, and situations that take place both within and outside a family setting. The following parameters reflect these aspects of parent-child interaction:

- Stages of child's development over which parent-child interaction occurs: infants, toddlers, preschoolers, adolescents, young adults, mature adults

- Types of situations and tasks within which parent-child interaction occurs: daily and periodic routines, chores, play and recreation, rituals, special events

- Settings within which situations and tasks involving parent-child interaction occur: family, neighborhood, school, community

Outlining the transfer situation in this way provides a sense of the *contexts* and the range and variability in the *surface features* it encompasses.

With respect to *deep features*, several types of themes relevant to interpersonal relationships have been conceptualized. These include role themes, interpersonal themes, and life themes (Schank & Abelson, 1977). Interpersonal themes are particularly relevant to parent-child interaction. Interpersonal themes reflect qualities of interpersonal interaction that reveal the underlying motivations and interests of the participants. Research on parent-child interaction and clinical work with parents and children over the past twenty years have revealed themes in parent-child interactions which reflect deep-lying interests and motivations of parents. Themes of sensitivity, responsiveness, reciprocity, and support have been found to characterize parent-child interactions and environments that encourage children's development. Themes of insensitivity, unresponsiveness, intrusiveness, and domination characterize parent-child interactions that constrain children's development. These themes are outlined in Figure 1.

Parents whose interactions with their children reflect sensitivity notice what their child needs. They accurately read the child's cues, the signals or messages the child provides (Ainsworth, et al., 1978; McGovern, 1990). Parents whose interactions with their children reflect responsiveness provide appropriate responses contingent upon their child's cues. They respond to the child's needs in ways that meet them, changing their approach to fit the child's developmental stage (Clarke-Stewart, 1973). Parents who engage in reciprocal exchange with their infant read and respond to the child's cues and, in turn, give signals that the infant learns to read and respond to (Bromwich, 1981; McGovern, 1990). First one, then the other influences the behavior of the partner (Clarke-Stewart, 1973). Finally, parents support their child's development by providing an environment that is stimulating and enriching visually, verbally, and with appropriate materials, trusting children to be capable and competent, participating in children's activities as a partner, and allowing children to actively explore even though it might be messy and not very convenient (Clarke-Stewart, 1973; Epstein & Evans, 1979; White & Watts, 1973).

Figure 1

Contrasting Clusters of Themes Reflected in Parent-Child Interaction

ENCOURAGE DEVELOPMENT THEMES	CONSTRAIN DEVELOPMENT THEMES
SUPPORT convey trust, interest, confidence; provide an enriching environment that assists the other person in meeting their needs and pursuing their interests	**DOMINATION** direct and control other person's thoughts, feelings, actions, and activities for purposes that do not include that person's needs or interests; exert power over other person
RECIPROCITY exchange, mutual give and take, turn-taking	**INTRUSIVENESS** interfere with other person's goals and activities
RESPONSIVENESS respond to other person's needs in ways that meet them	**UNRESPONSIVENESS** actions not connected to other person's needs
SENSITIVITY accurately read other person's cues, signals, messages	**INSENSITIVITY** miss other person's cues, signals, messages

Parental sensitivity and responsiveness characterize the interpersonal interactions of parents whose infants develop secure attachments and exhibit greater gains in cognitive and social development compared to infants whose parent-child interactions lack these qualities (Ainsworth, et al., 1978; Bradley & Caldwell, 1984; Bretherton & Waters, 1985; Bromwich, 1981; Lamb, Thompson, Gardner, Charnov, & Estes, 1984; McGovern, 1990). The presence or lack of these parent-child interaction qualities is also predictive of the quality of later parent-child relationships and of children's later relationships with others. For example, older children with sensitive parents appear to be more selfconfident, assertive, and socially competent than those whose parent-child interactions lacked this quality (Baumrind, 1975; McGovern, 1990).

In contrast to the qualities of parent-child interaction described above, parental insensitivity, unresponsiveness, and intrusiveness have been found to characterize the interpersonal interactions of parents with infants who develop insecure attachments and exhibit dependence and social incompetence (Baumrind, 1975; Bradley & Caldwell, 1984; Bretherton & Waters, 1985; Bromwich, 1981; Maccoby, 1980; McGovern, 1990). Parents whose interactions with their children reflect insensitivity fail to notice their children's cues, signals, and messages. Unresponsive interactions are reflected when parents act in ways that are unconnected with and, therefore, unresponsive to their children's needs, interests, and goals. As a consequence, children's needs are ignored which, in turn, conveys to children a sense of disinterest in them and a sense that they are not cared for or loved. Such children develop a sense of having little control over what happens to them which contributes to low self-esteem, lack of self-control, and deep feelings of anger and hostility (Maccoby, 1980).

According to Maccoby (1980), intrusiveness is reflected when parents interfere with their child's interests, plans, goals, relationships, and activities in ways that reduce or prevent the child's well-being, autonomy, and self-expression. Domination is reflected in directing the child in avenues that serve the parent's needs and interests without consideration of those of the child, in restrictions which set overly narrow limits on children's range of activities (ones which do not reflect a child's capabilities and interests), and in the arbitrary exercise of power and authority (do it because I said so). When parent-child interaction reflects qualities of intrusiveness and domination, children develop a sense of low self-esteem and rejection.

The four parental perspectives outlined earlier as intermediate-level knowledge are related to forms of *mental processing* that parents use in making sense of their children's responses and behavior, and in formulating policies to guide their own actions. As shown in Figure 2, parents' mental processes differ in relation to their perspective. Figure 2 reflects the intimate relationship between the parental perspective and the nature of thinking processes at each level of parental awareness. Because each higher level of parental awareness embeds the lower levels, Figure 2 reflects a nested relationship among the levels of awareness. Parents' thinking has been found to reflect one level of awareness most frequently, and adjacent levels some of the time (Newberger, 1980a; Newberger & Cook, 1983). Stress, unmet needs of their own, or other circumstances may cause parents' thinking in a particular instance, or at a particular time, to reflect a lower level of parental awareness than they are capable of reflecting. In addition, parents' thinking may reflect a different level of awareness in some areas of parenting than in others.

Figure 2
Parental Perspectives As Intermediate-Level Knowledge and Related Mental Processes
(Adapted From Newberger's Levels Of Parental Awareness)

Analytic

Perspective: Systems orientation—views parenting, self, and child as embedded within interacting, mutually influential systems of relationships; sees child as a complex psychological self-system; sees both self and children as growing and maturing through the process of parenting and the parent-child relationship; parenting practices seen as having broad origins, meanings, and consequences that extend beyond the parent-child relationship.

Mental Processes: Can recognize and accept ambivalence in own feelings and actions as a parent, and reconcile these with still loving and caring for the child; focuses on shared feelings and shared acceptance of each other's faults, frailties, and virtues, and each other's separateness as well as closeness in building parent-child relationship; can interpret motives underlying child's actions as reflecting simultaneous and conflicted feelings; interprets individuals and relationships in terms of both their stable elements and also as reflecting a continual process of growth and change.

Individualistic

Perspective: Child orientation—views children and themselves as unique individuals who also share some universal qualities; parent-child relationship seen as exchange of feelings and sharing of perspectives, rather than only as the fulfillment of role obligations.

Mental Processes: Tries to understand the child's world from the child's particular point of view, and the child in terms of his or her own subjective reality.

Conventional

Perspective: Norms orientation—views child and parenting practices in terms of conventional norms, including age-related norms for children's development and societally prescribed norms for child-rearing; sees self and child as members of a class or category having well-defined roles which it is their responsibility to fulfill; sees parent-child relationship as mutual fulfillment of role obligations.

Mental Processes: Draws upon tradition, authority, or conventional wisdom to inform expectations for children and parental practices; parental activity formulated and child understood in terms of the child's actions and inferred intentions in relation to preconceived expectations derived from outside sources; acknowledges that child has internal states and needs, but interprets them in a stereotypical way.

Figure 2 (cont.)

Egoistic

Perspective: Self orientation—sees the child and parenting practices only in terms of own interests and needs, in terms of how the child affects the parent.

Mental Processes: Organized in terms of achieving what the parent wants; focuses purposes of child socialization on maximizing parental comfort; parental activity formulated and child understood in terms of how the child's actions relate to the parent's needs; child care tasks and parenting interpreted as responses to other people or circumstances which affect the parent's emotional and physical comfort, or which offer approval to the parent; recognizes intentions of child, but does not separate them from actions.

What parents notice and what they ignore is influenced by their perspective. For example, it has been found that parents who accurately perceive their children's nature and needs can more adequately see the world through their child's eyes and can take into account a broader array of factors that might influence a child's nature and behavior than those who see their child only in terms of their own interests or conventional norms. Parents who can do this more complex mental processing are more likely to engage in parent-child interactions that are supportive of children's development than parents whose mental processes do not reflect this complexity (Brazelton & Cramer, 1990; Newberger, 1980a; Newberger & Cook, 1983; Sameroff & Feil, 1984; Sigel, McGillicuddy-DeLisi, & Goodnow, 1992).

Applying Principle II involved identifying situations involving parent-child interaction (the knowledge domain of interest) over which transfer might be reasonably expected and desirable. These transfer situations were defined as parent-child interaction situations that occur across children's developmental stages and within a great variety of activities and tasks, and that take place both within and outside a family setting. Defining the parameters of transfer situations in these terms revealed surface features and contexts which enabled incorporating these kinds of fidelity in the learning environment that was developed. Principle II also involved identification of deep features and kinds of mental processing relevant to these transfer situations as a basis for incorporating these kinds of fidelity in the learning environment. Like the identification of intermediate-level knowledge, research on parent-child interaction and parent-child relationships was a primary source for conceptualizing these two dimensions of fidelity. Once the different kinds of fidelity were conceptualized, ways of incorporating them in a learning environment needed to be determined. To do this, the remaining guiding principles needed to be considered.

Principle III: Reflect the Complexities of Knowledge and its Application in Diverse, Multidimensional Contexts, Problems, and Situations

As implied by the earlier discussion of high road transfer, knowledge transfer is often not straightforward. Reformulation and restructuring of prior knowledge, of problems, or of both is often necessary in order for transfer to occur. Because of this, *flexible knowledge* and *appropriately complex understanding* facilitate high road transfer. Flexible knowledge is connected to many different circumstances, problems, and situations. Its multiple, varied connections set the stage for further connection-making and for its being restructured in many different ways. Flexible knowledge is "many possibilities" knowledge. In contrast, inflexible knowledge is inert and isolated. It supports only low road transfer because it is activated only in the presence of a problem or situation that is very similar to that in which it was originally learned.

Flexible knowledge is especially critical in a societal context characterized by rapid and far-reaching change. In such a context, the same knowledge will need to be used in many different ways for different purposes, and the kinds of connections that learners will need to make cannot be completely or adequately characterized ahead of time. For example, machinists, who for years have drawn on their knowledge of metals and machining tools in order to manually set presses, punches, and other tools to produce metal components which precisely conform to specifications, are now programming computers to drive the machining tools. Their knowledge of metals and machining tools is still relevant, but must be recombined with new knowledge about computer programming in order to attain the specifications.

The way in which knowledge is learned influences how flexible it is. An assumption underlying teaching for knowledge flexibility is that knowledge that will need to be used in a lot of different ways needs to be taught in lots of different ways (Spiro et al., 1987, 1988). The flexibility of knowledge is believed to be enhanced when the learning situation emphasizes multiple contexts, problems, and situations that reflect multiple perspectives and purposes. For example, instead of using only one analogy, using multiple analogies forms multiple understandings that can complement each other in limitations and strengths (Spiro, Feltovich, Coulson, & Anderson, 1989). In contrast, inflexible knowledge results when general knowledge is too tightly or too exclusively linked to only one or a few examples, to only one or two contexts, or to one or a very limited set of problems, tasks and situations. Use of a single model, perspective, and purpose in teaching "welds" what is learned to that model, perspective, or purpose and hinders abstracting the general knowledge and connecting it with a wide range of different problems, tasks, and situations (Larkin, 1989; Spiro et al., 1987, 1988). As a result, students are not prepared to deal with the great variety of problems and cases that characterize complex, highly variable transfer situations (Spiro et al., 1987, 1988).

Complex knowledge has multiple interacting dimensions that create contradictions, ambiguities, and uncertainties. Application of knowledge is made complex by variability in forms and features of problems and situations. When these complexities are ignored, knowledge and its application appear neater and more regular than they are (Feltovich et al., 1989). The human tendency to reduce mental effort makes such oversimplification appealing (Feltovich et al., 1989; Scribner, 1984, 1986). Instruction can also contribute to learning of overly simplified knowledge. For example, teaching a continuous process as a series of discrete steps, teaching a multidimensional phenomenon one dimension at a time, incorporating as examples in instruction only the clearest, cleanest instances of a concept, and teaching something that is dynamic and constantly changing as a static phenomenon leave out critically important understandings (Feltovich et al., 1989). When such oversimplifications occur in teaching, the knowledge students learn has artificial characteristics which reduce its flexibility and lead to misconceptions. As a result, transfer is impeded or occurs inappropriately (e.g., undergeneralization or overgeneralization). Feltovich et al. (in press) suggest that the tendency to reduce complexity and variability in instruction is particularly problematic in the preparation of practitioners because problems that emerge in real-world contexts are complex, and the knowledge required to deal with them is not well understood or appreciated.

The perspectives that students bring to the learning situation can also contribute to oversimplified understandings (Feltovich et al., 1989). A perspective is something one thinks in terms of, a kind of lens that one sees with and that, at the same time, determines what is excluded from view. Students' perspectives can cause them to focus on only certain aspects of what is being taught and to ignore others. For example, students may interpret technical terms in relation to everyday common meanings and miss their technical meanings (Feltovich et al., 1989).

Broad experience over a wide range of situations that are highly varied in specific characteristics, but similar in thematic principles, is believed to facilitate construction of appropriately complex knowledge that is connectable in many different ways to many different specific problems and situations. Research suggests that learners can more easily construct deep feature knowledge, and that welding is prevented, when they experience a single context initially, only until identification and recognition of concepts becomes relatively effortless, and then experience more varied contexts (Bransford, Vye, Kinzer, & Risko, 1990; Gick & Holyoak, 1987).

Criss-crossing the landscape is an approach to instruction aimed at achieving flexible knowledge and complex understanding (Spiro et al., 1987, 1988). This approach involves the use of numerous cases that contain themes and other deep features, and which also reflect a wide variety of transfer situation surface features. In the criss-crossing approach, a domain of knowledge or practice is viewed as a landscape. Criss-crossing involves exploring a knowledge landscape from many directions, traversing it first this way and then that, preferably with a guide (e.g., the teacher) to highlight significant features. Criss-crossing the landscape involves exposing students to a wide range of real cases relevant to the domain, reexamining the same cases in many different combinations or clusters, and using a variety of abstract dimensions for comparing cases.

Two principles are used to structure the criss-crossing. In the first, cases are viewed as landscape "sites." In the second, concepts or principles are the landscape sites (Feltovich et al., 1989). When cases are used as the landscape sites, they are revisited for the purpose of exploring their multiple dimensions and the features that signal them. This process establishes multiple entry routes for later information retrieval and sets the stage for many connections to be made among cases (Spiro et al., 1987, 1988). When concepts or principles are used as the landscape sites, themes are used as routes of traversal among cases. That is, criss-crossing from case to case in many directions occurs along thematic dimensions. When cases are explored in this way, the same case is reexamined within many different clusters of cases, allowing learners to gain a sense of the range of ways that cases involving similar themes can present themselves. Methods for gaining a sense of the kinds of themes that connect cases have been developed (Spiro et al., 1987, 1988; Thomas & Englund, 1989).

The criss-crossing approach reflects the reality that applying knowledge is not always straightforward and that problems must often be perceived in a different way so a solution can be identified (Hudgins, 1977; Larkin, 1989; Scribner, 1986). Through confronting problems and cases that require knowledge reformulation in the criss-crossing process, learners develop an attitude of flexibility toward their knowledge. In addition, the case-based, criss-crossing the landscape approach provides more systematic exposure to a wide range of experiences in a briefer time than is possible through typical, everyday, real-world experience which is unsystematically encountered over long stretches of time (Spiro et al., 1987, 1988).

Application of Principle III: Reflecting Complexity of Knowledge and Creating Multiple Connections

A *criss-crossing the landscape* approach was used in the parent education learning environment to facilitate *knowledge flexibility* and *complex understanding*. Because interpersonal interaction situations have many specific surface features that contain significant information (e.g., facial expressions, voice tone, and gestures), and because video recordings of interaction capture these features and present them as they are experienced in the real world, a video format of case presentation was believed to offer more adequate surface feature fidelity than other potential formats. Cases of parent-child interaction containing the themes identified in Figure 1 were identified across the range of variability in transfer situation parameters outlined earlier. The cases were assembled from footage videotaped by project staff, from commercial movies and a series of educational videotapes that contained relevant scenes, and from a series of videotapes created as part of the data collection for a doctoral dissertation (Cooke, 1988). The cases depicted parents with their infants, toddlers, preschoolers, adolescents, young adults, and mature adult children, engaged in a wide range of activities within family, neighborhood, school, and community settings.

Patterns of adult actions established in prior research on adult-child interaction (Thomas & Englund, 1989) were used to relate adult actions that occurred in the parent-child interaction cases to the themes portrayed in Figure 1. These patterns are shown in Table 1 in relation to the two theme clusters.

Table 1

Profiles of Adult Actions With Children

Actions Reflecting Encourage Development Themes	Actions Reflecting Constrain Development Themes
Use child's name frequently	No name use except for control
Verbalization Reflect; acknowledge Concept-based labels Ask Encourage Give reasons Concepts and language understandable by children Let child ask for X	Verbalization Tell; ignore Value-based labels Threaten Shoulds Give rules Adult language and concepts Ask if child wants X
Get information, observe	Interpret, judge
Get child's attention before communicating	Communicate without getting child's attention
Engage, stimulate, encourage child's interest	Do activity even if child is bored, uninvolved
Change things midstream if child is not responding	Persist regardless of child's response
Join child in play	Divert, distract child
Much eye contact, positive visual expression	Little eye contact or positive visual expression
Body position near child and at child's level	Body position above child or far away
Move self into needed position vis a vis child	Move child into needed position vis a vis adult
Patient, calm, supportive, warm, gentle, relaxed voice tone, movements, touch	Fast, urgent, pressured pace, voice tone, movements, touch
Pace suited to child	Pace suited to adult
Focus attention on child; interact with child; alert to and tuned in to child	Focus attention on own needs, task, things, other people of interest to self; ignore child; self-absorbed
Sensitive to child's needs, feelings, agenda, cues; incorporate, combine, integrate own agenda with child's; reciprocal, mutual relationship	Adult needs, feelings, agenda, predominate; ignore child's cues; person in charge and dependent relationship
Child-oriented	Task-oriented
Process-oriented, learning-opportunity-oriented	Product-oriented, get job done
Involve child in task	Do task by self
Concerned with learning	Concerned with order, discipline

Table 1 (cont.)

Let child initiate his or her preferred activities; offer developmentally appropriate activities	Initiate activities adult likes, that meet adult's goals, and which the child might not be able to do
Follow child's lead; enter child's activity only enough to support child's goal and maintain safety	Intrude on, interrupt child's activities
Expectations of child based on child's developmental level and child's unique characteristics	Expectations for child based on adult's needs and desires
Tailor approach uniquely to the situation	Use stock approaches
Give choices	Order, command
Flexible, accepting, accommodating	Rigid, judgmental, rejecting
Allow child freedom to explore	Focus on conventional way, on caretaking, control, limits (e.g., doing it "right")
Let child problem solve	Give solutions
Let child do for self; verbally direct if needed	Provide unneeded assistance; do things for child that child could do
Respect child as a person; reward effort, independence, creativity, discovery, persistence	Reward child for performance, compliance
Provide accurate, extended, learning opportunities for child to develop own views.	Give child image, view that adult sees as desirable
See child's behavior as expression of individual and developmental needs and nature	See child's behavior as threat to authority
Connect with child through talking, playing together, facial and physical expressions	Connect with child through directives, criticism, advice

Source: Thomas & Englund, 1989

Each case in the database that was assembled was examined for the themes identified in Figure 1 by a panel of parent educators and university faculty serving as project consultants. Most cases reflected mixed themes. That is, a parents' actions in a case did not always reflect the encourage development theme cluster or the constrain development theme cluster, but, rather, some mixture of the two in which one of the theme clusters was usually predominant. Because both theme clusters were represented in the same case, the cases were viewed as having the potential to help students develop appropriately complex understandings relevant to the complexities of parent-child interaction in real life, and as avoiding overly simplified representations of theme expression.

Each case was given a title and coded for the themes and surface features it reflected. A database of cases and their codes was created to allow cases to be easily sorted on the basis of both themes and surface features. This database made it possible to select different groupings of cases on either basis in organizing cases for instruction. Before this organization was determined, principle four was considered.

Principle IV: Stimulate and Challenge Students to Transfer Knowledge During Learning, and Support Their Efforts to Do So on Their Own

Because high road transfer is intentional learning transfer, it reflects what is increasingly recognized by people who study learning and its transfer: Cognition interacts with motivational, emotional, and social aspects of a person's life (Resnick, 1989b). High road transfer depends on a stance of self-directedness on the part of the learner to use their knowledge in learning and understanding. Self-directedness is reflected in a tendency or disposition to actively desire and control learning. Learners express such desire and exert such control when they engage in intentional efforts to find links among elements of knowledge, develop explanations and justifications, and raise questions. In short, self-directedness has to do with learners monitoring themselves and viewing themselves as being in charge of their learning rather than expecting others such as the teacher to direct them (Resnick, 1989b).

The roles in which instruction casts students can either limit or support self-directedness. Roles in instruction that confront students with the need to reason with and transfer their knowledge help them develop a stance of self-directedness. In addition, direct teaching of thought processes, dispositions, and approaches for transferring learning supports students' self-directedness.

Intending to be helpful, teachers may unwittingly assume the very roles that, if given to students, would provide the necessary opportunities to engage in transferring knowledge. For example, it is possible for instruction to incorporate deep features without engaging students in mental processes critical to understanding, detecting, or applying these features. If the teacher simply points out the features of a problem, or uses a case to illustrate a point he or she is making, students are cast in a passive role, one in which they receive knowledge, intact, from someone else, rather than constructing and using it themselves (Perkins & Salomon, 1988). A better teaching approach for promoting learning transfer would be to engage students in actively examining cases, in abstracting the features that tie them together, and in connecting the features to new cases (Gick & Holyoak, 1987; Spiro et al., 1987, 1988).

Bridging is a teaching approach that gives students the role of transferring their knowledge and challenges them to do so (Perkins & Salomon, 1988). Bridging involves asking students to reach outside the immediate learning context to connect current learning with other contexts. Bridging questions can generate forward-reaching bridges from current experience and learning to possible applications (how, where, in what situations could this insight be helpful?), or backward-reaching bridges to prior experience and learning (is there anything you know from the past that could be helpful here?). Bridging might also ask students to connect something they have learned in one subject to something being taught in another subject. In addition to providing experience in the mental processes of reflection, abstraction, and connection-making, bridging is believed to increase the avenues of access to knowledge in memory by helping students integrate their knowledge. This latter feature of bridging is seen as contributing to overcoming artificial boundaries between subjects (Perkins & Salomon, 1988), and should be of special interest to those concerned with integrating vocational and academic education.

Other approaches to teaching that also engage students in transferring their knowledge do so within the context of learner-directed activities. Such activities provide opportunities for learners to develop a stance of self-directedness. One such teaching approach is *scaffolding* (Greenfield, 1984; Rogoff & Gardner, 1984). In a scaffolding approach to teaching, tasks, problems, and activities are not simplified. Rather, the learners engage in doing what is beyond their current capabilities with the assistance of environmental or interpersonal supports referred to as scaffolds. Scaffolds are described at some length in a separate report (Thomas, Johnson, & Anderson, 1992). The intent is to transfer what begins as shared responsibility between learners and teachers to the learners. The instructor follows the student's learning frontier, assuming the role of a sensitive partner who arranges the environment to support the learner's participation and accomplishment in the activities of interest. More support for the learner is provided initially; gradually the amount of support fades as the learner becomes more able to independently engage in the activities of interest. In the process, the learner acquires knowledge and mental processes needed for conducting the activity of interest and develops a stance of self-direction toward it.

Reciprocal teaching is a second approach that emphasizes learner-directed learning (Brown & Palincsar, 1989). Used to teach reading, it incorporates both scaffolding described above and cognitive apprenticeship described earlier. In reciprocal teaching, both teacher and students take turns assuming the teacher role in which discussion is a key element. Whoever is the teacher has responsibility for four strategic activities: questioning, clarifying, summarizing, and predicting. These mental processes, which good readers use to understand what they are reading, are made explicit and taught. Students practice them when they are the teachers as well as when they are students. These features reflect cognitive apprenticeship. T[illegible]cher scaffolds the teaching done by students in ways appropriate for the developm[illegible] of each student. The strategic activities provide opportunities for abstracting knowledge and applying it in other contexts, for transferring knowledge.

In addition to engaging students in transferring knowledge and giving them roles and responsibilities that allow self-direction in the learning process, teachers have been advised to teach transfer directly (Perkins & Salomon, 1988). *Direct teaching of transfer* is intended to help students develop conscious awareness of transfer as an issue in learning and using knowledge, and to explicitly teach strategies that students can use to direct their own transfer efforts. One avenue of direct teaching of transfer is *teaching thinking patterns and dispositions that help learners reduce or overcome biases which lead to oversimplified understanding*. For example, *considering views different from one's own* is a thought pattern that addresses the tendency human beings have to not give full attention to perspectives that oppose their own in reasoning about a claim (Brown & Palincsar, 1989; Paul, 1987, 1990; Perkins & Salomon, 1988). *Exploring the nature of a problem fully before considering possible solutions* is a thought pattern that addresses the human tendency to be solution minded, to jump quickly to conclusions about a problem and get on with figuring out its solution without giving adequate attention to understanding and defining the problem (Perkins & Salomon, 1988). *Self-monitoring* is a thought pattern which addresses the human tendency to not be conscious of or monitor one's own mental processes and behavior (Brown & Palincsar, 1989; Larkin, 1989; Perkins & Salomon, 1988).

Ways of helping students become aware of and develop such dispositions and patterns of thinking include setting the norms of the classroom to encourage them, calling learners' attention to them when they are evident or needed, explicitly discussing what they involve and what their benefits and their difficulties might be, and modeling them. In addition to cultivating and directly teaching thought processes and dispositions such as those above, a second approach to teaching transfer directly involves *making the recommended approaches to teaching for transfer explicit.* For example, Perkins and Salomon (1988) recommend *explicitly teaching the concepts of hugging and bridging* to students for use on their own in ferreting out what is specific and relevant to a single subject only, and what is an overarching principle in a subject area and relevant to other disciplines as well. It is also possible to *teach the concept of scaffolding* to students so that they can seek their own scaffolds, to *teach the concept of criss-crossing the landscape or reciprocal teaching* as ways of structuring one's exploration of a new area of learning, and to *teach the concept of fidelity* as an approach to considering and evaluating for oneself the extent to which one experience is reflective of another.

Application of Principle IV: Helping Students Learn to Transfer Knowledge

The stance of parents toward the knowledge reflected in the learning environment needed to be a personal one. It is one thing to watch another parent's interaction and to intellectually examine the levels of awareness and themes it depicts, and quite another to try to bring one's own deeply hidden perspectives to consciousness, to confront elements in them that may be disturbing, and to attempt to modify these old familiar lenses and construct new ones. Simply including parents in educational processes that focus on providing information about children's development and teaching parenting as a collection of skills is not likely to affect these deeper, critical parental perspectives (Bromwich, 1981). Likewise, learning about levels of parental awareness and themes in a detached, impersonal way is unlikely to transfer to parents' own practices. The higher levels of parental awareness reflect both personal awareness and sensitive awareness of children, and the capacity to modify and enrich one's own perspectives. For the learning situation to have fidelity in mental processes associated with these levels, it needed to engage parents in becoming aware of their own perspectives, and in considering the perspectives of children.

The learning environment, processes, and materials were structured to engage parents in the kinds of thinking identified above through bridging questions and the use of scaffolds. Three phases of instruction were created, each of which used different kinds of scaffolds. Each phase increased in difficulty and scaffolds were faded as parents' need for them declined. The following sections describe instructional procedures that were developed and piloted. Because parent education courses typically are short-term offerings, the learning environment was designed to entail approximately ten to fifteen hours of instruction.

Phase I Instructional Procedures: Developing Awareness Through Strategically Arranged Cases and Reflective Dialogue

Scaffolding was provided in the parent education learning environment by sequencing exposure to the videotaped cases of parent-child interaction in ways that made contrasts and similarities related to themes easier to notice, and by a series of open-ended questions related to the cases. Parents' first experience was with a group of cases identified as *contrast sets*. A contrast set was a pair of cases that were virtually identical in surface features but contrasted dramatically in the themes each reflected. For example, the two cases in a contrast set both depicted a parent and an infant at home engaged in a play situation using exactly the same toy. In one of the cases, the parent's interaction with the child reflected encourage development themes; in the other case, the parent's interaction reflected constrain development themes. These cases were exceptions to the mixed theme pattern referred to in connection with Principle III as characterizing most of the cases. The contrast set cases represented more polarized examples of themes. By keeping the surface features of the cases highly similar, the contrast in themes was heightened and easier for parents to notice.

A series of questions was used after the parent group had viewed each contrast set. The questions involved a *bridging* strategy that asked parents to generate their own observations and reflect on them, to abstract general meanings from the contrast set cases. The questions also asked the parents to focus on both the adult's and the child's perspectives as deeper, causal elements and consequences. Finally, the questions asked the adults to bridge to a future context by predicting. The initial questions were open-ended. These were followed by more specifically focused questions, which, in turn, were followed by questions concerning broader issues of consequences and implications. Examples of the questions included in this sequence were

> What was happening, what did you notice? What thoughts did you have as you viewed the scenes? What were your reactions?
>
> What actions did the adult take? What goals do you think the adult had? What goals do you think the child had? How did the adult's action, goal work for the adult? Why? How did the adult's action, goal work for the child? Why? How do you think the child felt? Why? How did the adult feel? Why?
>
> What do you think would happen if these actions and goals would continue? To the child? To the adult? To the adult-child relationship?

A second intent underlying the questions was to generate discussion among the parents for the purpose of introducing diverse perspectives. Parents in the group were themselves at different levels of parental awareness (see Figure 2) as was confirmed by the data presented in the field test reported in the next section. By verbalizing what they saw and their interpretations of it, and by hearing others do the same, parents were helped to clarify their own perspectives and become aware of alternative perspectives that differed from their own.

Once a sufficient number of contrast sets accompanied by the bridging questions were experienced for parents to gain a sense of the contrasting themes, the scaffold of contrast was diminished by introducing cases that varied in surface features and that were more mixed and subtle in themes reflected. These were introduced and discussed using the same series of questions that was used for the contrast sets. Once again the discussion among the parents reflected differing perspectives. Because these cases were more subtle and complex, they invited contradictions in interpretations. As parents struggled to understand views of other parents which differed from their own, they became more conscious of their own perspectives as well. When parents' examination of several of these cases reflected a sufficiently complex understanding of the themes, the second phase of instruction was introduced.

Phase II Instructional Procedures: Elaborating, Clarifying, and Connection-Making Through Concept Mapping and Reflective Dialogue

This phase was designed to involve parents in labeling, elaborating, and organizing concepts abstracted from the cases and their discussions of them. In this phase, each parent was asked to write down concepts and thoughts that summarized what they had learned during Phase I, and to organize these on a sheet of paper, newsprint, or on note cards in a way that made sense to them. Then, small groups of parents were asked to combine and organize their individual concept maps into a group composite. Like the discussion of cases, this sharing of each other's thinking confronted parents with understandings and concepts different from their own and aided their conscious awareness of their own views and alternative views. This phase also intensified the conceptual conflict because some resolution of contradictions in the concept organizations was needed. Because conceptual conflict facilitates cognitive reorganization (Champagne, Klopfer, & Gunstone, 1982; Doll, 1977), this phase supported parents in deepening, broadening, and reconstructing their own understandings. The concept mapping portion of this phase ended with the groups sharing their composite concept maps and discussing similarities and differences in the maps.

The exploration of cases as described in the latter part of Phase I also continued in Phase II. Now, however, instead of the instructor posing the questions as in Phase I, parents pursued their own issues regarding aspects of the cases that interested or perplexed them. Because an understanding of the themes was established in Phase I, and because their discussions and concept mapping in Phase II had involved them in confronting and coming to grips with different parental perspectives, their own questions addressed the themes and perspectives identified in Figures 1 and 2 in ways that had meaning to them. While the instructor still provided assistance in the discussion as a scaffold, entering the discussion when a significant point might be clarified or extended, or when specifically asked a question by the parents, the parents now had the lead in directing their own learning and transfer efforts. The parents asked their own bridging questions and contributed additional cases from their own experiences. Instead of being the central focus as the parents were in Phase I, the videotaped cases in this phase stimulated the discussions which pursued a theme or perspective in depth and which became the central focus and learning experience.

In the discussions, introduction of differing perspectives by parents continued but the discussions were now generative in focus, centering on patterns and problems they could see in their current perspectives regarding their children, their parenting, their relationships with their children, and the consequences of these patterns and problems. Insights emerged regarding alternative perspectives the parents were considering, trying out, or hoping to develop. This growing personal focus of the discussions set the stage for Phase III.

Phase III Instructional Procedures: Exploration and Revaluation of Own Practices

This phase was designed to support parents in focusing specifically on their own patterns of parent-child interaction for the purpose of becoming aware of the perspectives and themes reflected in them, and to support development toward higher levels of parental awareness and interpersonal themes supportive of their children's development. This phase most directly addressed issues described earlier regarding the need to help parents make their learning personal. The procedure described below was intended to support—to be a scaffold for—parents in seeing themselves, their children, and their parent-child interaction through the lenses that they had been developing throughout Phases I and II, and in connecting the concepts they were developing within the group sessions to their own parenting practices.

In contrast to the other phases which occurred in a school or community center, part of this phase took place in each parent's home. The procedure used for the in-home portion of this phase was modeled after a stimulated recall procedure used by researchers to study people's thinking in situations involving interpersonal interaction (Calderhead, 1981). The in-home session began by creating an informal, supportive atmosphere. The instructor then asked the parent to engage with their child in free play activities for about fifteen minutes while the instructor videotaped the interaction. The tape was then immediately replayed in short segments while the parent and the instructor watched. At the end of each segment, the instructor asked the parent to verbalize what they had been thinking during the interaction depicted in the segment, and to infer what their child was thinking and feeling: "What were you thinking here?" "What was on your mind?" "I wonder what (child's name) was trying to do here, was feeling, was thinking?" The entire procedure required sixty to ninety minutes. The parent was offered a copy of the tape to encourage reexamination of the interaction and continued reflection.

During this phase, exploration of cases in the group sessions also continued as described in Phase II. By this time, however, parents' discussions were deeper, focusing immediately on underlying perspectives, themes and other abstract principles and concepts, and on connecting these to their own childhood, to other interpersonal relationships in their lives, and to a wide array of contexts and specific situations which included the workplace and the community.

Summary

In this section, four principles for guiding curricular decisions, instructional development, and teaching practices to enhance transfer of learning were identified. Application of the principles in the development of a learning environment in parent education was reported. The overall aim of the learning environment was helping parents develop their capacities to support their children's development. The learning environment was developed to support high road transfer by focusing on parental perspectives as intermediate-level knowledge, on mental processes accompanying the perspectives, and on themes as deep features of parent-child interaction. A case-analysis approach to instruction was developed to help parents construct flexible knowledge and appropriately complex understandings. A bridging strategy was used to stimulate knowledge transfer during learning. Learner-directed knowledge transfer was supported through a scaffolding approach to teaching and through reflective dialogue among the parents. Goals underlying the learning environment were to support parents in constructing perspectives grounded in accurate understanding of children's general and individual nature and complex understanding of parent-child relationships—Principle I; constructing interpersonal themes that center on sensitivity, responsiveness, reciprocity, and support—Principle II; transferring what they learn to different stages of children's development, varied types of situations and environments, and to roles and relationships beyond parenting—Principles III and IV; and becoming aware of their own perspectives and themes which govern their parenting practices—Principle IV. The next section reports the field study that investigated the impact of the learning environment on parents' learning.

IMPACT ON LEARNING OF INSTRUCTION GUIDED BY THE PRINCIPLES

This section addresses the third purpose of the research—testing the impact of instruction, based on the principles, on transferable learning by students. A field test of the learning environment was designed to provide evidence regarding the learning of parents who experienced it as a way of exploring the strength of the guiding principles that influenced its development. Two kinds of data were sought as evidence of transferable learning: (1) the presence of characteristics of transferable learning and (2) transfer of learning by parents. Characteristics of learning that is transferable in the high road sense reflects intermediate-level knowledge, deep features, flexibility and appropriately complex understanding, and a stance of self-directedness on the part of the learner toward it.

While impact on learning was the major question addressed by the field study, the field study also provided an opportunity to explore two theoretical issues surrounding the design of the learning environment. The first, discussed in connection with Principle I, has to do with the difficulty of determining intermediate-level knowledge central in a domain or area of learning. Data generated by the field study provided an opportunity to empirically investigate assumed relationships between parental perspectives (intermediate-level knowledge) and parent-child interaction (the knowledge domain). The second issue, discussed in connection with Principle II, had to do with conceptually sorting out intermediate-level knowledge and deep features. Data generated by the field study also provided an opportunity to investigate relationships between parental perspectives as intermediate-level knowledge and themes as deep features.

Site Selection and Participant Recruitment

Parent education programs are lodged within many different kinds of settings and are frequently jointly sponsored. In Minnesota, where the field testing occurred, parent education programs supported by vocational funds have been coordinated within larger administrative units which encompass multiple sponsors and provide a range of services to parents (Cooke & Thomas, 1985). Contact was made with directors of fifteen programs located within school district adult and community education units, community service centers, medical clinics, and child care centers regarding their potential interest in participating in the testing of the learning environment. These programs were located throughout Minnesota's largest metropolitan area and were known to serve parents of infants. Their clientele represented a range of age levels and socioeconomic characteristics.

Selection of sites from among the eight contacts expressing interest was made on the basis of the following criteria: program enrolls primarily first or second time parents of infants, willingness of parents enrolled in programs and program staff to participate in the study on a voluntary basis, willingness of the site to include the experimental learning environment within their program structure, representation of a range of socioeconomic status and educational backgrounds, desire to involve a sufficient number of parents in the study to make statistical analysis of data reasonable, and the need to keep the scope of effort within project resources. The preference for programs that enrolled first or second time parents of infants was related to research summarized earlier which indicates that the interactions between parents and children that are established early in the child's life influence the quality of the parent-child relationship that develops. The desire to involve parents having a variety of characteristics was related to an interest in ascertaining the flexibility of the learning environment in serving audiences having different educationally relevant characteristics.

Five sites were selected for the field test. Three sites were Early Childhood Family Education (ECFE) adult parent education programs. Established in Minnesota in 1975, ECFE programs grew rapidly during the 1980s as a result of legislative action which gave school districts state funds and the option to levy local funds to support them through their adult and community education units. They have been a common administrative unit through which vocationally supported parent education has been provided. Two of the programs served suburban, middle class parents. The third ECFE site was an outreach program for parents referred by compensatory programs such as Head Start in which their children were enrolled. The fourth site was a university campus child-care center in which a parent group was formed especially for this study from a pool of university staff and students whose young children were cared for by the center. The fifth site was an ECFE-coordinated teen parent program that was a required component in an alternative high school completion program located in a suburban high school. The remaining three sites that expressed interest were involved in piloting the learning environment and research procedures. These sites included a teen parent intervention program, a program that enrolled middle-class young adults and middle-age parents, and a second university day-care site in which a group of parents was also formed.

Implementation of the Learning Environment

In all cases except the university sites, the learning environment was inserted into an existing parent education program. A total of thirty-one parents enrolled in the five field test programs. The two suburban sites were comprised of nine and eight mothers, respectively. The outreach site included three mothers and one father. The university site included three mothers and one father, and the teen site included four mothers and two fathers. In all of the sites, the learning environment was implemented in the three phases described earlier. The teen group, however, did not experience the in-home session part of Phase III due to their reluctance to be videotaped. Group sessions were scheduled once per week and were one-and-one-half hours in length. Parents in the two suburban sites had ten group sessions and one individual, in-home session. Parents in the university and outreach sites had six group sessions and one individual, in-home session. The teen parents had ten group sessions.

All sessions in four of the sites were taught by a project staff member rather than the regular instructor. In one of the suburban mothers' sites, however, the regular instructor cofacilitated the sessions. In the teen site, the regular instructor, who received training from project staff, taught all of the sessions because of issues surrounding rapport and trust that are of special concern in teen parent programs.

Data Collection

Data collection was designed to obtain evidence regarding transferability characteristics reflected in parents' learning and evidence of parents' actual transfer of learning. More specifically, data was collected to detect change in parental perspectives (intermediate-level knowledge); change in participants' theme expressions (deep features underlying parent-child interaction situations); participants' connection of their learning to a range of relevant problems and issues (flexibility and appropriately complex understanding; learning transfer); and personal intent and self-monitoring of participants with respect to what they had learned (stance of self-directedness). Table 2 relates these kinds of evidence to the goals of the learning environment and the four teaching for transfer principles, and to the sources of data from which the evidence was obtained. Procedures and instruments used in collecting this data are discussed on the following page.

Table 2
Instructional Goals, Evidence, and Data Sources

Goals Underlying the Learning Environment	Evidence	Data Source(s)
1. Principle I—Constructing perspectives grounded in accurate understanding of children's general and individual nature and complex understanding of parent-child relationships.	Change in intermediate-level knowledge	Pre- and post-Parental Awareness Interview
2. Principle II—Constructing interpersonal themes that center on sensitivity, responsiveness, reciprocity, and support.	Deep features	Pre- and post-Parental Awareness Interview
3. Principles III & IV—Transferring learning across stages of children's development, types of situations and environments, and to roles and relationships beyond parenting.	Knowledge flexibility and appropriately complex understanding Self-directedness: personal intent Learning transfer	Group session transcripts Post-Parental Awareness Interview Group session transcripts, post-Parental Awareness Interview
4. Principle IV—Becoming aware of own perspectives and themes which govern parenting practices.	Self-directedness: self-monitoring	Post-Parental Awareness Interview

Data regarding changes in parental perspectives (see Figure 2) and changes in parents' theme expressions toward sensitivity, responsiveness, reciprocity, and support (see Figure 1) was obtained through a semistructured *Parental Awareness Interview* (Newberger, 1979, 1980b). This interview was conducted with parents during the month prior to the initiation of participation in the learning environment and was repeated during the month following the final class session. In the interview, parents were asked to describe their child, what they enjoyed about their child, what they did not enjoy about their child, what parenting was like for them, what about it was satisfying, what about it was difficult, the sources of their ideas about parenting, what children need from their parents, how parents know what children need, and what goals they had for their children. Additional questions were generated during the interview to follow up on and elicit elaboration of parents' responses to these ten questions. Each interview required approximately one-and-one-half hours to complete. The interviews were conducted in parents' homes and were recorded on audiotape. The project staff member who provided the instruction in four of the sites conducted the interviews for those sites. In the teen site, the regular instructor did the interviews after receiving training from project staff. In addition, at the teens' request, these interviews were recorded by interviewer's notes rather than tape recorded.

The *Parental Awareness Interview* has been used to determine level of parental awareness in several studies (Newberger, 1979, 1980a). In these studies, interrater reliabilities of .84 and .96 and an internal consistency coefficient of .81 have been reported for the coding documentation for the interview. Construct validity for the stages of parental awareness has also been reported. Using the interview data as evidence of theme expression has not been previously reported. The use of the interview data for this purpose was accomplished by a coding procedure that is described in the data analysis section.

In several instances, it was not possible to obtain a pre- and post-interview from a parent. This was the case for all teen participants who would agree to participating in only one interview. In addition, some participants in the other groups moved during the field test, or took extended vacations, which precluded their completion of the sessions. These occurrences represent limitations of research conducted in naturalistic settings. Pre- and post-interviews were obtained for seventeen participants.

Group sessions were audiotaped. Transcriptions of the tapes were a source of data regarding the flexibility of parents' learning, the complexity of their understanding, and the degree to which they engaged in transferring their learning to relevant problems and issues during the learning process. The post-Parental Awareness Interviews were the source of data regarding parents' intent to transfer their learning, self-monitoring, and on-their-own transfer of learning to their own situation and beyond.

In addition to the above data regarding learning impact, data regarding demographic variables and qualities of parental interaction behavior with their children was obtained. A demographic questionnaire was developed to obtain data regarding parents' educational backgrounds, age, number of children, and age of children. The videotapes of each parent engaged in interaction with their child made during the individual, in-home session during Phase III of the learning environment were used as the source of data regarding qualities of parent-child interaction. This parent-child interaction data was used in exploring the assumed relatedness of parental perspectives (intermediate knowledge) to parent-child interaction (knowledge domain). The teen parents were not willing to have their group sessions audiotaped or themselves videotaped. Consequently, this data was not available for this group. In addition, for reasons indicated above in connection with the interviews, an individual, in-home session could not be scheduled for some parents in the other groups. A parent-child interaction tape was obtained for eighteen parents.

Data Analysis

Interviews were transcribed and transcriptions were segmented and coded for parental awareness level and theme. Procedures recommended by Newberger (1979) for determining parental awareness level were used as a guide in segmenting the transcripts and in coding them for level of parental awareness (see Figure 2). Each interview segment was also coded for which of the eight themes (see Figure 1) was most predominantly reflected. Predominance was determined by the proportion of the response that reflected each theme if more than one theme was evident. The segmentation and coding was done by three researchers using a procedure in which the code assigned to each response was negotiated among the researchers. Following initial coding, the codes were checked again twice by two of the researchers using the same procedure. For each interview, the proportion of responses at each of the four levels of awareness was calculated. In addition, the proportion of responses that expressed encourage development themes and that for responses which expressed constrain development themes were calculated. The t-test for correlated data was used to compare pre- and postproportions of parental awareness level responses and pre- and postproportions of theme responses.

Transcriptions of the audiotape recordings of the group sessions were examined for a sense of the extent to which parents' learning was flexibly connectible to varied, relevant problems and issues, reflected complexity of understanding, and indicated that parents were transferring what they were learning during the learning process. Flexible connectibility was indicated by evidence that parents could link concepts they were learning to different stages of children's development, different types of situations or tasks involving children, different settings, and to roles and relationships beyond that of parent-child. Post-interview transcriptions were content-analyzed for expressions that reflected a stance of self-directedness on the part of parents toward what they had learned in terms of personal intent and self-monitoring, and for evidence of on-their-own transfer of learning to their own situation and beyond.

Finally, the parental awareness level that characterized the majority of a parent's pre-interview responses was identified as the parent's overall level of parental awareness. This overall level of awareness was used in two analyses. In the first analysis, a descriptive rating scale was used to assess the qualities of parent-child interaction reflected in the videotapes of parents' interaction with their children. This scale, adapted from the *Parental Behavior Rating Scale* (Mahoney & Powell, 1986), describes five levels for eight dimensions of parents' participation in parent-child interaction: (1) enjoyment, (2) sensitivity to child's interest, (3) responsivity, (4) acceptance/warmth, (5) effectiveness, (6) pace, (7) supportiveness, and (8) nonintrusiveness. A parent's ratings on the eight qualities were added for a total rating. A mean of the total ratings was calculated for parents at the egoistic, conventional, and individualistic levels of parental awareness. Since there was only one analytic-level participant, a mean for this level could not be obtained. A one-way Analysis of Variance (ANOVA) was used to compare the three means. In the second analysis, the mean percent of pre-interview encourage development theme responses and the mean percent of pre-interview constrain development theme responses was calculated for parents at egoistic, conventional, and individualistic levels of parental awareness. A one-way ANOVA was used to compare the encourage development means. It was not necessary to run an ANOVA on the constrain development means because relationships among them were the same since these were mirror images of the encourage development means.

Findings and Discussion

Demographic Characteristics of Field Test Participants

As reflected in the description of the sites and implementation of the learning environment, most participants were female. The twenty-seven female and four male participants reflect a gender profile similar to that of the vast majority of parent education programs. Participants varied widely in age from parents who were still in their teen years to those who were near forty. The largest age span, from early twenties to late thirties, was reflected among parents in the university group. The teen group, the most homogeneous in age, included eighteen and nineteen-year-olds. Ages of outreach group parents ranged from early twenties to early thirties. Ages of parents in the two suburban groups spanned the late twenties to the late thirties. Educational levels ranged widely from parents in the teen group who were still in high school to parents who had completed graduate degrees.

Parents in the two suburban groups and the university group had all completed some college and several held one or more degrees. Parents whose highest level of educational completion was eighth grade, high school, and postsecondary technical school programs predominated in the outreach and teen groups. All but one parent in the teen group and all parents in the university group had one child. About half of the outreach and suburban parents had two children. No parent had more than two children. All of the children were infants or preschoolers. Many of the parents had several years of experience in various work and community roles.

Change in Intermediate-Level Knowledge (Level of Parental Awareness Responses)

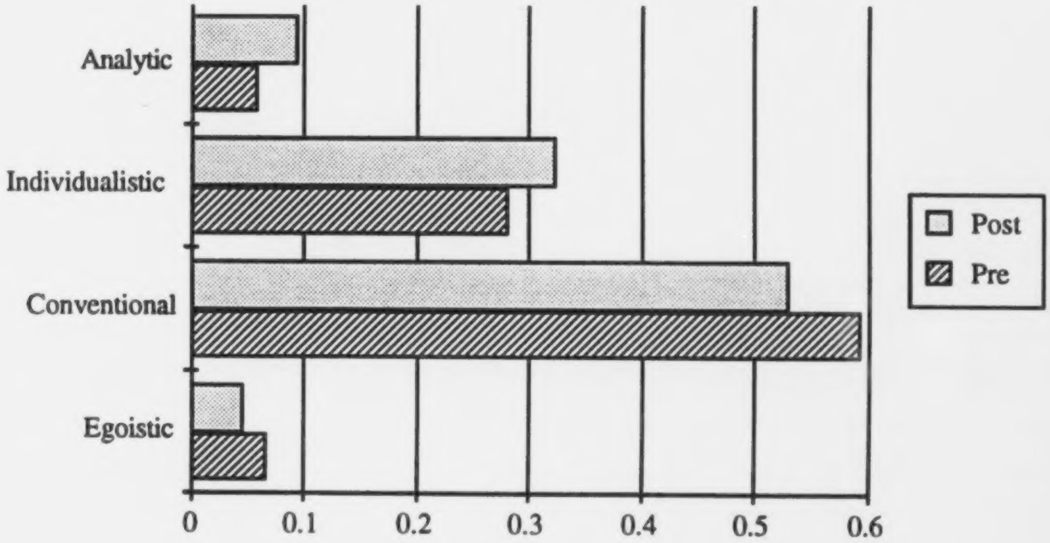
Figure 2 provides a description of the characteristics of the four levels of parental awareness. An illustrative interview response for each level of parental awareness is indicated below. These were all responses to the question, "What is hard about parenting?"

> **Analytic Response** (systems-focused; parent-child relationship embedded within a larger system). Well, I do worry very much about the whole, societal kinds of things and pressures and expectations, how for her as a female quick to be stereotyped in terms of what is right for girls and what is right for boys. I'm concerned about that. Also, in my youth the whole drug notion where there was almost some idea that recreational use of drugs and alcohol would be a social problem that might be resolved—and now within fifteen years it has become a very serious problem in the United States. I don't think that is all of a sudden going to be eradicated. So, the wrestling of the whole drugs and the limits on her as a woman, as well as I think some of the limits with her Hispanic background, so I am concerned with that for her. That kind of influences how I try to interact with her and the kind of a setting I want for her.
>
> **Individualistic Response** (child-focused; child is a unique person). It's hard when she becomes frustrated by not being able to do something for herself. That becomes frustrating for me, too. But we try to work things out together. I try to listen to her, to see things from her point of view, and understand why she may be feeling that way.
>
> **Conventional Response** (norms-focused; developmental norms for children). They get out of this difficult stage. I think and I know this because I was a day-care person. When they get to be three or four they are a little more independent, they can bathroom themselves, they can dress themselves to a point and they are not as much physical work, the carrying. They are holding your hand and there is more of a verbal exchange in a lot of ways. There are a lot more motor skills they can handle.
>
> **Egoistic Response** (self-focused; how child affects the parent). Well knowing that it is a twenty-four-hour-a-day, seven-days-a-week job that

> you can't just pick up and go like you used to, there is a lot less freedom and when they are cranky and crabby and you wish you could just go do something else or just have them stop. I guess that's frustrating.

Figure 3 portrays the change in the mean proportion of interview responses at each level of parental awareness for the seventeen participants who completed both the pre- and post-interview. As Figure 3 indicates, participants' post-interview responses reflected lower proportions of egoistic and conventional responses, and higher proportions of individualistic and analytic responses than did their pre-interview responses. The decline in conventional-level responses was significant (one-tailed $t= 2.09$, $df=16$, $p=.05$). More detailed statistics underlying Figure 3 are presented in Appendix A. The patterns reflected in Figure 3, decrease in responses reflecting less complex perspectives and increase in responses reflecting more complex perspectives, suggest that the learning environment did address its first goal (see Table 2) and that learning change in intermediate-level knowledge occurred.

Figure 3
Change in Mean Proportion of Interview Responses at Each Level of Parental Awareness (N=17)



Change in Deep Feature Responses (Themes)

Figure 1 provides a description of eight themes reflected in parent-child interaction as deep features. An illustrative interview response for each theme follows, along with the question that elicited the response.

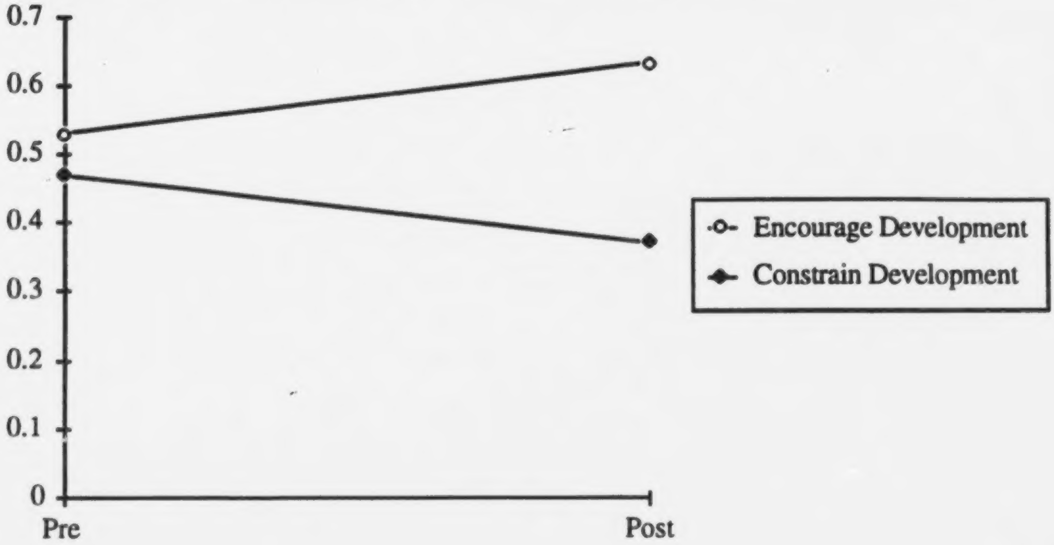
Encourage Development Themes	Constrain Development Themes
Support (provide an enriching environment that meets needs and assists child in pursuing interests): Q. What do you enjoy doing with Tommy? A. He is really fun to be with. It is fun because everything is so new and everything is so wonderful, a blade of grass, the sidewalk, rocks. Even now we have been saving empty grocery containers, and the lids from the milk and juice containers, syrup bottles, and he does pretend play which he wasn't doing before. He stirs them up and moves them around and he has a little cart with the groceries in and he knows what they are for the most part. He opens the boxes and pours them into things and everything gets pretend syrup on it.	**Domination** (direct and control, exert power over): Q. What do you enjoy doing with Amy? A. Everything. I like to teach her things. I got her coloring books, reading books, and we play games. I have had a very hard time with Amy and in the long run it was all worth it because she is so good. She is so good now, she listens. I mean sometimes I had to warn her. I'd just sit down and say, 'Hey, if you're not going to do something, then you can either sit there for fifteen minutes or you get a slap and you can't do nothing all day, just stay in the house. Half the time she would just stay in the house.
Reciprocity (mutual give and take): Q. How would you describe a good parent-child relationship? A. I think it would be a patient relationship, that both of us would be patient with one another and kind of willing to listen. Sometimes I worry that I don't listen closely enough to Lisa, to what she is trying to tell me, so you know, I wish sometimes I had a little more patience to listen and I guess I would want her to do that with me, too. You know, respectful, I guess respectful of the differences between the two of us.	**Intrusiveness** (interfere with other person's interests, activities): Q. What are some things you don't enjoy? A. She's got a strong will. If she wants to do something, she is head strong, she is real hard to steer into something else, so I don't like bringing her in from outside because she doesn't like that. She'll kick and yell and scream. She doesn't like it in the car. She will kick and scream there, too. She wants to be doing something.
Responsiveness (respond to other person's needs in ways that meet them): Q. What are some things that Lisa is doing? A. She is struggling now with getting her words out. She'll get going and go 'pffft and say,' 'Mom, help me,' so I will say, 'What you can do is sit down and take a deep breath,' and then we can try again. She now can reach the pedals on her trike but she can't figure it out and that has been frustrating because she wants to make it go, and I've been working with her to try to teach her how to do it.	**Unresponsiveness** (actions not connected to other person's needs): Q. Is there anything else about Danny that might have changed? A. Sleeping patterns are the same—sometimes I use my Walkman so I can't hear him cry. It's like the pressure, I don't know, I don't really like it, to hear him crying. I can't relax. Then I put my headphones on. But I still can hear it anyway.

Encourage Development	Constrain Development Themes
Sensitivity (accurately read other person's cues, signals): Q. How does a parent know what a child needs? A. Well, they are all different. Just reading from day one their body language or however they can communicate with you. She is at an age now that she uses sign language and different sounds and that's how we communicate. If she wants me to read she brings me a book, if she wants to eat a banana, she points to the bananas, but if she wants to cuddle, she just comes right on over and cuddles. That's how she lets us know what is going on. It is just something you learn from the time they are born. They all have their own ways of telling you. Some are a lot more vocal and some are a lot quieter about it, but they communicate with you, even when they are real tiny. We debate—should we let her cry, and I say, 'no, there is a growl in that cry. She is hurting.' There are just little things that you pick up on, you can hear just a certain pitch in there and you know what they need.	**Insensitivity** (miss other person's signals, cues): Q. How does a parent know what a child needs? A. I don't know. That's a tough one. A lot of times you don't. If they're not old enough to tell you, it's really hard to guess. Sometimes she can whine for a while and I can try everything and just nothing is the right thing, you know. It's very frustrating. If a dad was here I could say 'Go see your dad, maybe he can figure it out.'

Figure 4 presents the change in the mean proportion of interview responses expressing encourage development and constrain development themes for participants who completed both the pre- and post-interview. Responses reflecting encourage development themes increased and responses reflecting constrain development themes decreased (one-tailed t=3.06, df=16, p<.01). More detailed statistics underlying Figure 4 are presented in Appendix B. The patterns reflected in Figure 4 suggest that the learning environment addressed its second goal (see Table 2), and that learning of deep features of parent-child interaction supportive of development occurred.

Figure 4

Change In Mean Proportion of Interview Responses Expressing Encourage Development and Constrain Development Themes (N=17)



Knowledge Flexibility and Appropriately Complex Understanding, and Learning Transfer

The extent to which parents' learning reflected knowledge flexibility and appropriately complex understanding was examined by reviewing the transcriptions of the group session discussions. These transcripts revealed the range, depth, and complexity of thinking that occurred in the reflective dialogue among the parents. The group session transcripts revealed parents' efforts to transfer what they were learning by engaging in reflection, abstraction, and making connections.

The degree of flexibility and complexity in the understandings parents developed in the reflective dialogues and their learning transfer during these dialogues is illustrated in the following group session excerpt. This excerpt is from the fifth group session at the university site. The reference at the beginning of the excerpt is to the contrast set cases of two different mothers playing with their infants in very different ways that the parents had seen in Phase I. The reference to these cases at this point in the instruction reflects the depth of the impression these cases made. Revisiting this earlier experience spawned a discussion of sensitivity and domination, interwoven with the question of infants' capabilities. The infant capabilities question is one which has pervaded more recent child development research literature and is still far from resolved. The opposing viewpoints expressed by parents and the implications parents drew for what they should assume and how they should respond to young children reflect an understanding of the complexities and uncertainties that surround this question. In the dialogue, the parents integrated the abstractions of sensitivity, domination, control, respect, and needs, and connected these abstractions to different stages of children's development, to adults, to different situations involving children which included some in their own life experience, and to various contexts including work. Their exploration of these abstract and complex concepts was extended, intense, and reflects a search for integration of the concepts:

> And if I were to look at it from a baby's aspect, I would—
>
> If you are a little baby, you think your mother is being insensitive.
>
> Give me that toy and play with this toy, don't play with that toy, play with this toy, and I would feel—
>
> I really think though, Rose, I don't think a baby is sitting there thinking, 'My mom is insensitive to my needs.' But I do think the baby—I think we aren't giving them enough credit.
>
> They definitely express frustration, but I don't think it matters what age they are—like when I take something away from Jerry—he'd think that I was being mean and insensitive now.
>
> I guess what I am talking about is, they do react.
>
> Frustrated or whatever.
>
> It's interesting to me to think of all the advantages that come from not ascribing to a child all of the virtues and sensitivities of a mature adult when it comes to emotions. . . . Yet, I think that they are operating on a very sophisticated level. I'm amazed at this little two and one-half year old. I think they're more sophisticated about feelings—hurt their feelings. When Lisa screams at us, she screams in the exaggerated scolding that we have done to her. "Don't you do that to me." It's like—that's us.
>
> Yeah, or maybe it is condescending I think. Sometimes I think the behavior of some of the parents in the cases we saw was condescending. You know, sticking that toy in the baby's face. Babies know what they like and don't like. They like the one they are reaching for. So it's condescending in that respect.
>
> Dominating too, I think too, domineering.

It's kind of hard not to be dominating when you are so much bigger and more powerful. What I was thinking of when I think of this power thing, I think of the mom that kind of let the baby do what the baby wanted to do. It was like who—first I was thinking—who was really controlling? The baby was controlling because the mom let the baby do whatever she wanted. But then I was thinking, in one of the cases, really the baby was in control because the baby allowed herself to not get upset when the mom wanted to change the child's behavior. By doing that, the baby was really controlling the mother —by acting that way as opposed to in the other one. In the other case, the baby wasn't really controlling the mom. The baby was just doing what it wanted to do and the mom was just letting it.

It was like at first I thought the baby was in control. The mom was just letting go. But really, by being able to control moods of your parents, you're really controlling them.

Parents are afraid to lose their power and so we have to push our will on—not that it was that extreme.

I think these are good ideas, but I think they come into play at different ages. I think definitely at two and one-half, or even at one and one-half, the kid can understand, you know, about controlling the parents. But I think an infant, six months, nine months—I don't think they really have a grasp of that.

I disagree—all the time Jerry knew how to get me. I mean if they are crying.

How do you know if that is what they are doing?—or are you just projecting?

Superimposing.

I think they know at a very early age that they do certain things that get reactions. They might not know always what reaction, what kind, but I think—

But in a way that could be considered controlling.

Well sure, if they know they cry and that will get them something, then they cry. They know they will get picked up or they will get food.

Jerry doesn't cry so much any more because I say, "Just go ahead and cry." But he does other things. Like last night I had a couple phone calls, so I had to be on the phone and he gets really mad if I am on the phone too long. He was walking around throwing things, climbing on things he wasn't supposed to climb on. I had to get off the phone and watch him because he was doing things that were dangerous. He was climbing up on this high chair and trying to pull things down and he was going into his room and coming out five minutes later without a diaper on. He did things I had to go take care of so I couldn't be on the phone. He was doing those things deliberately knowing that I'd—(not saying now mom is going to have to take care of me)—but these things he knew would get me off the phone.

But as far as the crying to get food, I just think there is a difference between responding to your environment in a way that's survival instinct and something where the kid doesn't want the mom on the phone so he knows what he can do.

Well I think we are talking degrees.

More purposeful, you mean more purposeful?

We're talking degrees. I mean obviously it's not going to be the same as at two and one-half, but you'd have a hard time convincing me that even newborns aren't going to have at least some degree of knowing at some level there is a response action.

It's only because we let them know. I'm thinking of Jerry and he would cry all the time to eat and I'd let him eat. I'd let him nurse. He was nursing like once every hour. It was like every time he cried, I didn't want him to. I didn't know what was wrong with him, so I thought he was hungry or just wanted to be next to me so I'd let him nurse. So he just knew, if that is what he wanted to do, he knew exactly what to do.

To do this. I think, Rose, your point in the whole issue has complex dimensions. I think human behavior on an adult level can be explained by a need. We have certain needs that are more sophisticated, and we think in terms that are certainly beyond the needs that a child has, but we are struggling, dressing a certain way, to have some kind of a need met for recognition. That's the same kind of dimension as their wanting attention—pulling something down because they think you are spending too much time attending to the phone and you should be attending to them. You know at work we spend $1,000 on a new suit to get an interview so that we get that kind of recognition and attention that will make an impression on the interviewer. So I think the need idea is kind of a common thing throughout in that we are trying to have needs met, whatever they see as their needs—warmth, touching, clean diapers or burp, or whatever.

Well just getting back to how this all ties in with the control and who is controlling who. I think the kind of studies they do—I've taken Cindy to some things where they show her a screen and she is supposed to blink at it at three months old and they are supposed to learn something from this. It never worked. She was at one where they were going to do her brain waves, but she ripped the things off her head. Anyway, I think that you don't ever really know. Maybe it is something they can get from brain wave studies, but unless you have one of those monitors at home, most parents are never going to know. You can imagine or have a pretty good feeling about why the kids are—but I guess maybe tying that into the respect thing, it is probably better to err on the side of assuming that they do know what is going on and treat them with respect rather than—

Assume that they are this little neophyte.

> And I think that is a really good point, we don't know that for sure, but I guess they are a human being and so there is this sense that—my sense is they know more and feel more than I like to think they do. And I would want to be respectful of that. And plus I guess I sort of think from the very first that's how they learn too. That's how they learn feelings and all of the values that are my values is by me being that way to them. So it's like I can't wait until they are two or three and then suddenly be this—
>
> Switch gears.
>
> Switch gears. It's like I think you just do that from the beginning.
>
> When they are that young, they obviously have some concept of what is being done because you can feed a child all they need and not give them any warmth and love and they die. So obviously they know. They perceive what you are putting in. It is just that process.
>
> Right. That may be where the argument comes in. Not that it happens overnight, but when does it happen, it's better to err on the side of assuming that it happens from day one as opposed to waiting until they are five or six or two-and-a-half.

The rich connections and complex understanding reflected in the transcripts and exemplified by the above excerpt, suggest that the learning environment addressed its third goal (see Table 2). Parents were able to transfer their learning to many different situations during the learning process and to initiate the transfer themselves.

Stance of Self-Directedness, and Transfer of Learning to Own Situation and Beyond

Content analysis of post-interview transcripts for evidence of self-directedness on the part of parents toward their learning revealed dimensions of self-monitoring and personal intent to transfer learning. These responses often appeared toward the end of the interview as summing up thoughts or ideas about future directions. A number of these expressions referred explicitly to the role of the group sessions in influencing changes in perspective and behavior and formation of intentions. Because the expressions reflect connections forged by parents between their learning and their own situation and beyond, they represent evidence of transfer of learning by parents. Because they reflect conceptual change—seeing the familiar in new ways—they represent evidence of the kind of learning on which high road transfer depends.

Illustrative examples of post-interview responses that reflect the patterns outlined above follow. The first set of responses reflect the *self-monitoring* dimension of self-directedness. The first response refers to a videotaped case of interpersonal interaction involving a supervisor and an employee that was used in the group sessions to help parents see the relevance of what they were learning to roles and relationships beyond that of parent-child:

> *Q. I don't have any more questions, but would you like to summarize or share any more of your ideas about what it is like to be a parent or conclusions you have made?* A. I think a theme that the course has been able to reveal is the subtlety and the lifelong impact, that the strategies for being a good parent for an infant are probably the same basic foundation and strategies that are going to be useful as we relate as adults or as we try to relate to our children when they are adults. I think it was evident in the evaluation pieces, too—that simple tie back of how this man and woman related in the management clip was real, real important for me. It's like wow, that's the kind of connection that I would have made in an academic sense, but probably not made it as soundly. It was only that they were side by side that I realized there was some connection—so that was real usable.
>
> *Q. What do you think children need most from their parents?* A. You know, the first words that pop into my head are this notion of love and respect. That seemed to be something in our discussions in the course that really came to the fore for me, was that to be respectful of their independence and autonomy and just them as a human. I would no more jerk someone around, like I see—it would be just unacceptable for me to come up in Target and jerk someone around as an adult, be they a family member or not, the way I see parents jerk their kids around and drag them out. That's just disrespectful. I think the rethinking of what is the value of control, control for control's sake. It may be a value for them as an adult to get some sense of control. I'm not sure that doing it through a role of a parent, kind of lording over the child, is the most effective way to have them get a sense of power. I think the questioning of to what end? Where is this little battle for control leading us, is a valuable piece, too. Once again, that is a piece that I think the video cases helped me get a sense of—you know, the whole exposure to education. The same way that you jerk them around when you rush them out of Target because they wanted something, I mean, then you try those same kinds of techniques with fifteen- and sixteen-year-olds, and it is probably going to get you to the same place.
>
> *Q. Have your approaches to getting Abbey to do things changed, been different in any way?* A. After taking the class, I think I am not as black and white as I used to be. I think I was more—there is a right way to do things and a wrong way to do things, and my way is obviously the right way. I have changed. I'm not as stringent in my thinking as I used to be. I think I am more able to allow her to go at her own pace instead of trying to force something as much. And it has given me good and different ideas on how to introduce things. I see it because things between my husband and myself, when we talk about just different things, I can kind of see a difference in the way I used to think because of the way he talks and the way I think now.

> *Q. How would you describe a good parent-child relationship?* A. I think if the parent is in tune to the child's needs and looks at the child as an individual and not you know, here is child A, B, and C and treat them all the same. I mean I think a good parent should try to look at their child and see how they need to parent that child instead of "This is the way I am and you better conform to my parenting or else." I think that is important, which is something different than when I first took the class.

The following post-interview response examples also illustrate self-monitoring but go further than those above in that they express parents' *intents to transfer learning* in relation to what their self-monitoring had revealed to them:

> *Q. What might be some things that you would do to create this relationship that you would desire?* A. Well to talk more with my wife and discuss, help kind of define for us in our relationship more of what is good. That is where I got a bang out of the class in going there and coming back. It was useful as just a reference for us to discuss things. Patty and I were able to do it together because it is a priority and a value and we don't make it a physical kind of time priority, so it was great for those hours once a week that we spent some time in parenting. So the question might be for us, how do we make that a priority on a regular basis because I think parenting is certainly challenging enough that Patty and I wouldn't deny that it deserves a regular hour of our thinking time and discussion time.

> *Q. So that leads up to the last question I have. If you are going to be creating this relationship with Lisa that you want, what kinds of things would you do in order to have it happen? How would you create, or what are you going to do to promote that?* A. Well, I think it's like maybe what we are doing now, which is that I'm really trying to listen to her and to know her and to appreciate who Lisa is and, kind of accept her. I think another thing I picked up from the class, is that when I do challenge and offer new information, to do it in a way that is not going to discount where she is, what she is thinking. I don't know, to be real sensitive to that I guess. I want her to feel like she is appreciated, you know. Certainly loved, I don't think there will be a question about that. But I want her to feel appreciated and respected and considered. I guess I want her to know that her mom is going to have an opinion but it isn't necessarily a reflection that she's bad and I'm right. I know we are not going to agree. I think that is part of the challenge, too, is that there is this side of it and this is how I am feeling. I think if I can be real honest with that, this is how I am feeling. And I don't think there is anything wrong with once in a while, especially when she gets older, certainly hearing her and then saying, "Well, have you considered, you know, or you know, this could be a consequence of that." I feel like I need to do that. That's kind of me anyway. I'm pretty opinionated. But I do hope that it's toned down in a way that I'm not going to hit her over the head with it either. I figure the only way she is going to make choices is that she begins to be able to make some and if they are ones she has trouble living with or not good ones, we kind of go on from there.

Q. In conclusion, do you want to say more about your parenting and goals you have for parenting and your relationship with LeeAnn? A. You have got to keep an open mind. You learn something new every day about yourself and your children and to keep an open mind. Positive communication, spending time with LeeAnn, as much as she needs at different levels and stages in her life, is important. The classes have been really insightful. I'm having a difficult time letting go of my ideas that she is not this little adult that knows and can follow my directing. I need to be more flexible in letting her make decisions that she is capable of. Positive communication and understanding where they are coming from at different stages is important. I have to feel comfortable with letting her tell me more what she needs.

Q. Have you noticed that you are doing things differently with Lisa now than previously? A. Well, I think one thing, sort of as a result of the class. I have been trying to back off a little bit. Not back off in a negative way, but I have a tendency to play with Lisa a lot. We do a lot of one on one stuff. Sometimes I think I am too directive. I try to just be more conscious of that, kind of go with her a little bit instead of kind of setting it up, because she will ask me to play with her a lot. She will say, "play with me, play with me," but I found, I think as a result of the class, that usually I kind of set up the scenario. Now, if we were playing with the playhouse, if this is the game, I kind of try to let her initiate it and then kind of go with that. In fact I have found lately if I do get too directive, like I'll take Cookie Monster or something, "Oh, Cookie Monster is going to go down the slide," she will say, "You can't do that! I don't want him down the slide." So it is like I kind of back off, "Okay, you tell me what you want Cookie to do." So I have been more conscious about that.

Q. What goals do you have for raising your child? A. That's a good question. I don't think consciously about goals, but, to provide them with what they need in life like providing her with a sense of knowing who she is, liking herself, and feeling comfortable with herself. The class has been helpful in making me see the potential there is in each child if one only looks for it. Letting the child tell us, show us what they need. We as parents have to become more observant and try to understand where they are coming from, not trying to interfere or impose our wishes on them. My goal would be to seek out ways to allow Maureen to be her own person. To provide opportunities for her or remove obstacles. Like I have been babysitting my sister's baby since February. I can see where that is becoming an obstacle for Maureen. I can't be with her as much as she needs me or I would like. I can now understand what my mom was experiencing when I was little. But this is not good for Maureen's psychological development, so I decided to not take my sister's baby anymore. That was difficult to tell her when you are family, but Maureen's development is more important. It's in the process and I need to be able to respond to her. Parenting is very fulfilling, but the responsibility is on me as a parent to provide the guidance for my child's growing up. Being comfortable with who I am as a person can help me to pay attention to Maureen and be there to help guide her in ways that she needs. If we can establish a good sound relationship now, that is important to what happens

> down the road when she is a teenager. Those are responsible tasks that need attention.

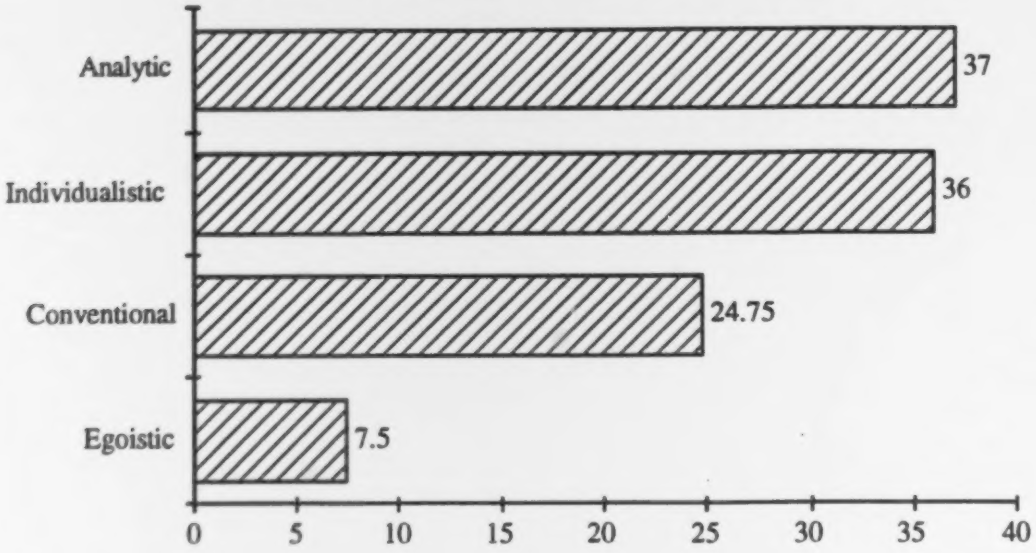
These illustrative post-interview excerpts reflect thoughtful insight on the part of parents regarding themselves and their own practices in relation to learning environment concepts. They were clearly restructuring their prior understandings of themselves, their children, and their practices as parents. The connection-making on the part of parents reflected in the post-interviews revealed that parents were transferring their learning on their own. These dimensions reflected in post-interviews provide further evidence that the learning environment addressed its third goal, and evidence that it also addressed its fourth goal (see Table 3).

Exploration of Theoretical Issues

Findings regarding the two theoretical issues that the field study provided an opportunity to explore are reported here. The first issue was knowing if parental perspectives identified as intermediate-level knowledge were as relevant as anticipated to the domain of parent-child interaction. In other words, was there any connection between parental perspectives and how parents actually interacted with their children? To answer this question, each parent's level of awareness was identified as the level within which the majority of their pre-interview responses fell. Mean total *Parental Behavior Rating Scale* ratings were determined for parents at each level of parental awareness except the analytic level, which was represented by only one parent. Figure 5 portrays the total parent-child interaction rating for the one analytic-level parent and mean ratings for parents at individualistic, conventional, and egoistic levels of parental awareness. Higher ratings reflect more developmentally supportive interaction qualities. Figure 5 indicates that interaction quality ratings were higher for parents at each higher level of parental awareness. The number of participants at each level of parental awareness in Figure 5 is the number for which a videotape of the parent's interaction with their child was obtained. A one-way ANOVA used to compare the three mean ratings revealed significant differences ($F=5.818$, $df=2,14$, $p=.01$). These findings support the relevance of parental perspective, as determined by the pre-Parental Awareness Interview, to the domain of parent-child interaction and suggest that parental perspective and behavior are related.

Figure 5

Parent-Child Interaction Rating for One Analytic Parent and Mean Ratings for Parents at Individualistic (N=3), Conventional (N=12), and Egoistic (N=2) Levels of Parental Awareness

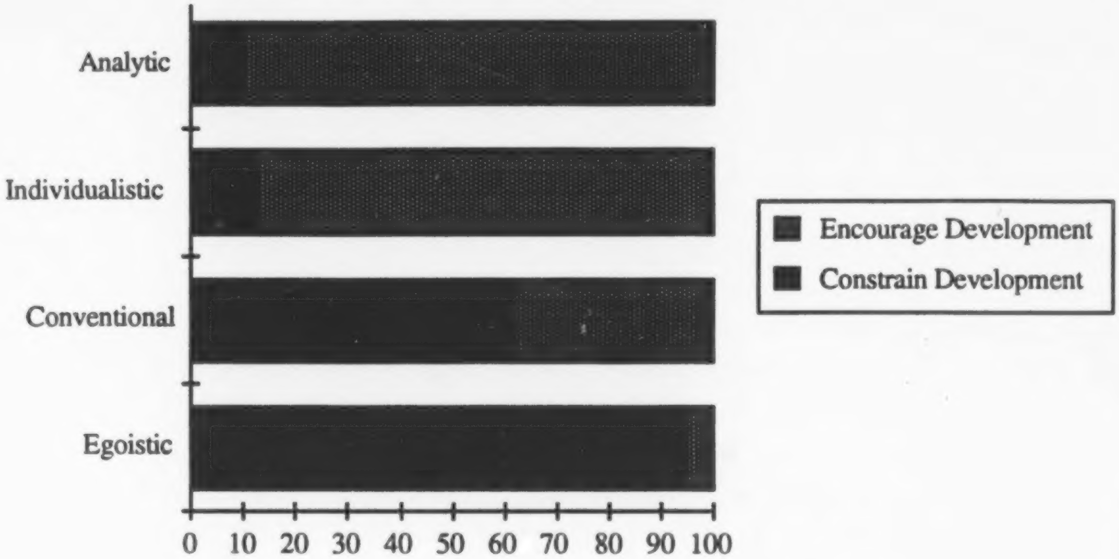


The second issue, conceptually sorting out intermediate-level knowledge and deep features, was empirically investigated by analyzing relationships between level of parental awareness and themes. Intuitively, it is not unreasonable to think that parental perspectives, as depicted in the four levels of parental awareness, underlie themes. For example, parents at an egoistic level of awareness who see their child in terms of their own needs and interests, and parents at a conventional level of awareness who see their child as a member of a category, could be expected to reflect less sensitivity to their child than parents at individualistic or analytic levels of awareness. Figure 6 reflects the percent of encourage development and constrain development pre-interview theme responses for the one analytic-level parent and the mean percents for parents at individualistic, conventional, and egoistic levels of parental awareness. Teen parent interviews were omitted from this analysis since the note-taking method used to record their interviews resulted in far less detailed and extensive interview data than that resulting from the tape recording method used for the other groups. This was not an issue in the analyses already reported since teens were omitted from them because of completing only one interview and not participating in the in-home session that provided the videotape of parent-child interaction.

Figure 6 indicates that more encourage development and fewer constrain development theme expressions occurred for parents at each higher level of parental awareness. A one-way ANOVA used to compare the three encourage development mean percents revealed significant differences (F=17.80, df=2,20, p<.001). This analysis was also applicable to the three constrain development means for the reason given earlier. These findings reflect a strong relationship between intermediate knowledge and deep features, one which needs further empirical and conceptual exploration.

Figure 6

Percent of Pre-Interview Responses Expressing Encourage Development and Constrain Development Themes for One Analytic Parent and Mean Percents for Parents at Individualistic (N=4), Conventional (N=16), and Egoistic (N=3) Levels of Parental Awareness



The rationale underlying the use of pre-Parental Awareness Interviews to determine parental awareness level had to do with the nature of intermediate-level knowledge. Because intermediate-level knowledge takes considerable time to develop, it was assumed that change in parental awareness level would be unlikely to occur within eleven to sixteen hours of instruction. To check this assumption, parental awareness level was determined for parents who completed the post-interviews. With one exception, there was no difference between parents' pre- and postawareness levels. The exception was a parent whose pre-interview indicated a high conventional level (high was indicated by almost as many individualistic responses as conventional ones) and whose post-interview reflected a majority of responses at the individualistic level. The data presented in Figure 3 reflects a pattern which suggests that a longer experience with the learning environment would likely have produced a number of changes in parental awareness level.

Despite the fact that overall parental awareness level did not change, proportions theme responses, the other factor in the analysis associated with Figure 6, did change. These changes could have made some difference in the relationship between themes and parental awareness level reflected in Figure 6. To check this possibility, a similar analysis was run using post-interview levels of parental awareness and post-interview theme responses. This analysis revealed a similar relationship between parental awareness levels and themes (F=27.508, df=1,14; p<.01).

Summary

The learning environment was field tested in five sites in order to ascertain the strength of the teaching for transfer guiding principles on which it was based. Thirty-one parents of varying ages, educational backgrounds, and socioeconomic situations experienced the learning environment in various educational settings for six to ten one-and-one-half hour sessions. In addition, eighteen of these parents experienced a one-and-one-half hour, in-home session. Data was collected before, during, and after parents' participation in the learning environment regarding transfer-related characteristics of parents' learning, their learning transfer, and their behavior. Findings revealed that parents' learning did reflect characteristics identified as enhancing transfer, that parents did transfer their learning, and that dimensions of parental cognition addressed by the learning environment and parental behavior were interrelated. More specifically, findings indicated that

- Parents' perspectives (intermediate-level knowledge) became more complex and encompassing.
- Parents' expression of themes reflecting deep features of parent-child interaction shifted toward themes relevant to supporting children's development.

- Knowledge flexibility, appropriately complex understanding of abstract concepts, and transfer of learning were reflected in the range of connections parents were able to make between the concepts and multiple contexts, problems, and situations, and between the concepts and highly specific situations as well as broad, general ideas.

- Self-directedness and transfer of learning to parents' own situation and beyond were reflected in parents' post-interview responses that focused on self-monitoring and a personal intent to transfer their learning.

- Parents' perspectives were related to their interaction behavior with their child.

- Parents' perspectives and themes were related, implying a relationship between intermediate knowledge and deep features.

CONCLUSIONS

Conclusions are outlined below in relation to the purposes of the research indicated in the introductory section. These purposes were to identify principles, based on transfer of learning research and cognitive theory, for guiding curricular decisions, instructional development, and teaching practices in ways that support transferable learning; test the applicability of the principles by using them to guide curricular decisions, instructional development, and teaching practices within a specific vocational education program area; and test the impact of instruction, based on the principles, on transferable learning by students.

Regarding the first purpose, four principles for guiding curricular decisions, instructional development, and teaching practices to support transferable learning were identified. These principles are

1. Emphasize intermediate-level knowledge in curricular decisions;

2. Create in the learning situation fidelity to transfer situations;

3. Reflect the complexities of knowledge and its application in diverse, multidimensional contexts, problems, and situations; and

4. Stimulate and challenge students to transfer their knowledge during learning and support their efforts to do so on their own.

The principles address both low road and high road transfer and the different kinds of learning appropriate to each but they emphasize high road transfer and the kinds of learning upon which high road transfer depends. The basis for each principle and ways of incorporating it in educational practice were identified.

The second purpose addressed by this research was to test the applicability of the principles by using them to guide curricular decisions, instructional development, and teaching practices within a specific vocational education program area. This purpose was addressed by using the principles in creating a parent education learning environment. The following conclusions are based on this experience in applying the guiding principles:

- *Because they represent broad areas of consideration, the guiding principles are flexible and anticipated to be applicable to curricular decisions, instructional development, and formulation of teaching practices in many different subject areas.* Because the principles are broad, there are many different ways to apply them. Rather than highly specific prescriptions, the guiding principles provide a way of organizing thinking about curricular decisions, instructional development, and teaching practices.

- *Instruction guided by the principles was adaptable to different settings, audiences, and time frames.* Application of the guidelines resulted in a highly flexible design for instruction that was adaptable to educational programs in different contexts, and which served audiences that differed widely in age, educational background, and socioeconomic characteristics. While the limitations on the data collection in the teen parent program were many and frustrating, they were not totally surprising. Similar problems had been experienced in the pilot teen site, and issues of privacy are a commonly experienced barrier to research with teen parents. Despite these problems, inclusion of the teen parent program in the field test provided a valuable opportunity to determine the adaptability of the parent education learning environment to a high school-age audience and high school setting. In all of the sites, the learning environment was able to be tailored to differences in learners' characteristics and needs, and to the capacities and constraints of the educational setting. The learning environment was adaptable to the ten- and six-week formats required in each site for the group sessions. It was also evident that it could have offered rich educational experiences over a much longer period of time than its tryout in these sites allowed.

- *Application of the principles revealed the importance of a deep understanding of the knowledge domain and of research in making that understanding possible. The need to sort out conceptual meanings of intermediate-level knowledge and deep features was signaled by field study data that confirmed their interrelatedness.* The understanding that research has made possible of perspectives and themes related to parent-child interaction was necessary in order to be able to apply the principles in developing the learning environment. The relationship between the perspectives and the qualities of parent-child interaction reflected in the field test data offers support for the validity of the research on which the choice of parental perspectives as intermediate knowledge was based. The field test data that revealed a relationship between intermediate-level knowledge and deep features suggests that further examination of these two concepts contained in Principle I and Principle II, respectively, is warranted in order to be clearer about their potential conceptual similarities, distinctions, and potential overlap.

Regarding the third purpose of the research, testing the impact of the instruction based on the four principles, on transferable learning by students, the following conclusion is based on field test findings:

- *Learning by students who experienced instruction guided by the principles reflected transferability characteristics relevant to high road transfer and was transferred by the students to multiple contexts, problems, and situations.* Transferable learning, in the high road sense, reflects intermediate-level knowledge, deep features of problems and situations, is flexible and reflects appropriately complex understanding, and is seen by learners as responsive to their own direction and intent. Rather than simply moving the same understanding from a familiar situation to an unfamiliar but closely identical one, this kind of learning leads to conceptual change—to getting oneself to see differently, to generating new insights that transform old perspectives. Evidence obtained from the field test of the learning environment suggests that the learning by parents which occurred during the field test had these characteristics. Furthermore, learning of this depth and complexity occurred over a relatively brief time. Students transferred their knowledge in many different ways during instruction as well as after instruction had ended, as post-interviews indicated.

Will these characteristics of learning promote continued transfer over time when parents no longer have the stimulation and support provided by the learning environment? Although this study was not designed to answer this question, there are several clues that prompt speculation. First, it was clear in the post-interviews that the perspectives and themes on which instruction was focused had been integrated by the parents into their thinking about their own child and their own practices. This suggests that these new perspectives and themes are likely to continue to influence parents' policies and practices regarding their children over time. Second, the revisiting by the parent groups of cases they had examined earlier suggests that these cases made deep impressions. If this is so, parents may continue to mentally revisit cases on their own and draw on them as difficulties and satisfactions arise with their children. Finally, a number of comments parents made during the interviews and group sessions indicated that they were thinking about things during their experiences in the learning environment which they had never before considered. It is possible that the learning environment served as a catalyst, setting in motion thought processes that will be self-sustaining.

How far parents will transfer their learning is another important question that this study leaves open. The evidence from the field test suggested that parents did transfer their learning to themselves and their own situations. Some evidence also suggested that parents made broad leaps between the insights gained in their experience with the learning environment and roles and relationships beyond the parent-child relationship. For example, in one of the post-interview excerpts included in the findings section, the parent linked what they had learned about parent-child relationships to human relationships throughout life and to those in the workplace. In the excerpt from the group session transcript, parents linked their insights about children to insights about adults in the workplace. These connections reflect transfer over considerable distance. Because parent-child interaction involves a more mature and a less mature person engaged over time in interpersonal interactions which have human development consequences, understandings about parent-child interaction are potentially applicable to a much broader set of human interactions that are similar in these respects. This broader set might include, for example, interpersonal interactions between teachers and students, supervisors and employees, trainers and trainees, mentors and mentees, coaches and team members, and masters and apprentices.

IMPLICATIONS FOR VOCATIONAL EDUCATION

The nature of the guiding principles and their consequences for instruction and learning have implications for vocational education research, educational practices, and curricular priorities. These implications include

- *Focusing instruction on intermediate-level knowledge, deep features, and mental processes requires a different kind of research than that which underlies much instructional development in vocational education.* Intermediate-level knowledge and deep features relevant to parent-child interaction were identifiable because research that has revealed them has been completed. Examples of this kind of needed research permeate the cognitive literature (e.g., Jones & Idol, 1990; Resnick, 1989a; Rogoff & Lave, 1984; Schön, 1983; Sigel et al., 1992; Sternberg & Wagner, 1986; West & Pines, 1985). Some examples are also reported in the vocational education research literature (Cooke, 1988; Johnson, 1988; Thomas, 1992). By and large, however, vocational education research is not focused on providing such information. Much vocational education research intended to support curriculum and instructional development has emphasized behavioral task analysis. Behavioral task analysis does not provide the kind of information needed to support instructional development that enhances high road transfer. Rather, it leads to instruction which emphasizes low road transfer. This is because its focus on observable, behavioral dimensions of transfer situations emphasizes surface features and developing well-practiced habits for specific tasks and settings. Because behavioral task analysis focuses on specific tasks rather than emphasizing breadth of application or the deeper concepts and principles and mental processes on which high road transfer depends, it is not well-suited to developing instruction that fosters high road transfer.

In addition, because behavioral task analysis relies on clearly identified, precisely defined transfer situations, it is less viable in a context of rapid change, unpredictability, and complexity. In such a context, transfer situations are likely to have many unknown aspects which cannot be defined, or to have too many variations and dimensions to allow definition of all of them. Curriculum development relevant to such transfer situations requires an approach which addresses deeper, broader kinds of fidelity and in which surface features play a less central role.

- *Application of the guiding principles requires understandings and teaching practices that may differ from those teachers have learned.* Applying the guiding principles requires an understanding of intermediate-level knowledge, deep features, and mental processes relevant to transfer situations and knowledge domains of interest. Teachers' opportunities to gain such understanding is hampered by the lack of research indicated above. In addition, teachers may not have had opportunities to learn approaches to teaching and curriculum and instructional development that support high road transfer if these were not emphasized or modeled in teacher preparation programs. Unavailability or cost of materials and experiences (e.g., cases, simulations, and field site placements) may limit teachers' opportunities to provide rich opportunities for students to experience transferring knowledge in a multiplicity of situations. Despite these obstacles, many teachers have undoubtedly learned to teach for transfer. Studies that document this kind of teaching exist in the vocational education research literature (Dinham, 1989; Stasz, McArthur, Lewis, & Ramsey, 1990).

- *High road transfer is a relevant priority for vocational education.* Although there is evidence that teachers do teach in ways consistent with the guiding principles, Perkins and Salomon (1988) contend that these practices are rarely done persistently and systematically enough to overcome an overriding priority on memorization and recall of facts. Because transfer requires learning well and deeply, it is unlikely to be sufficiently addressed unless priorities reflected in educational systems are reexamined. To a large extent, vocational education priorities have focused on low road transfer. This is reflected in concerns about up-to-date equipment in teaching laboratories, industry-based observations of specific job tasks, and relation of training to employment at a specific level. As the forces of rapid change and increasing complexity exert their influence on the workplace and other arenas of life, high road transfer is becoming increasingly important. Trends in vocational education that reflect concerns related to high road transfer include the view that training should have relevance to industry-wide employment, and the interest in integrating vocational and academic education.

This does not mean that low road transfer is unimportant. It means that it is not sufficient. As already indicated in the discussion of the guiding principles, introducing more general knowledge within specific, meaningful contexts and problems aids initial learning of the general knowledge. Unless instruction goes further than this, however, to engaging students in abstracting the general knowledge from its specific attachments, the general knowledge is likely to remain welded to specifics and to be of more limited usefulness than is possible or desirable. Striking an appropriate balance between teaching for high road and low road transfer is becoming an increasingly important and challenging problem for educators. Teaching in a way that incorporates specific problems as starting places, as vehicles for stimulating and providing a base for further learning, is one way of approaching the challenge.

- *Ways to assess transferable learning are needed.* The kind of learning that leads to high road transfer is not assessed by tests of knowledge recognition, recall, and performance in a narrowly defined arena. Assessments that can detect complex and deep understanding, and integration, flexibility, and reconstruction of knowledge are needed. Recent work on assessment has begun to move in this direction (e.g., Feltovich, Spiro, & Coulson, in press; Thomas, 1988; West & Pines, 1985).

RECOMMENDATIONS

The following recommendations for teachers, researchers, teacher educators, and policymakers are based on the conclusions and implications outlined in the preceding sections:

- In light of increasing needs for high road transfer in a societal context of rapid change and growing complexity, give more emphasis in vocational education to high road transfer and to approaches to curriculum and instructional development that support it.

- Further test the guiding principles, their consequences for instruction and learning, and their usefulness by applying them to instruction in various educational areas at all levels, and involving a variety of audiences, and by using them to support efforts aimed at integrating vocational and academic education.

- Conduct research to determine the extent to which the guiding principles are already expressed in vocational programs.

- Focus research efforts on understanding intermediate knowledge, deep features, and mental processes relevant to transfer situations and knowledge domains of interest in vocational education. Involve teachers in these research efforts.

- Expose teachers through preservice and inservice teacher education to concepts and issues related to high road transfer of learning and to approaches for developing instruction and teaching that address such transfer.

- Identify ways of assessing transferable learning that already exist and develop new approaches for assessing such learning. Look for evidence that students are transferring learning both during and following instruction. Determine persistence and breadth of transfer over time.

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APPENDIX A

Change in Proportion of Interview Responses at Each Level of Parental Awareness (N=17, df=16)

	Pre		Post			
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	**t**	**p**
Analytic	.06	.14	.09	.25	1.34	.20
Individualistic	.28	.24	.32	.28	1.12	.28
Conventional	.59	.27	.53	.31	2.09	.05
Egoistic	.07	.11	.05	.08	1.52	.15

APPENDIX B

Change in Proportion of Interview Responses Expressing Encourage Development and Constrain Development Themes (N=17, df=16)

	Pre		Post			
	Mean	Standard Deviation	Mean	Standard Deviation	t	p
Encourage Development Theme Responses	.53	.28	.63	.23	3.06	.01
Constrain Development Theme Responses	.47	.28	.37	.23	3.06	.01